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Vol. 10, No. 4, February 29, 1956

GENERAL

ATOMIC BOMBS AND WARFARE

Refer to abstract 1846.

RESEARCH PROGRAMS

1692
THE INDUSTRIAL DEVELOPMENT OF ATOMIC ENERGY.
Atomics 6, 380-5(1955) Dec.

The work of the research and development branch of the industrial group of the United Kingdom Atomic Energy Authority is summarized. In this branch, research is applied to industrial needs, and all aspects of design and construction problems of nuclear power reactors are studied. (M.P.G.)

BIOLOGY AND MEDICINE

1693   UCLA-326
California. Univ., Los Angeles. Atomic Energy Project.
THE SIZE AND SHAPE OF HYALURONIC ACID FROM VITREOUS HUMOR. John W. Rowen and Robert Brunish. Mar. 15, 1955. 39p. Contract AT-04-1-GEN-12.

Both the concentration of the polysaccharide and the ionic strength of the solvent affect the extinction angle, birefringence and light scattering properties of dilute solutions of the sodium salt of vitreous hyaluronic acid. The data obtained indicate a molecular weight of 1.27×10^6 and a molecular length varying between 2 and 3×10^3 A, and are best interpreted in terms of a "soft" or "flexible" asymmetric molecule which does not assume a spherical shape under the conditions employed. (auth)

1694   UCRL-3191
California. Univ., Berkeley. Radiation Lab.
THE METABOLISM OF THE LANTHANONS IN THE RAT. II. TIME STUDIES OF THE TISSUE DEPOSITION OF INTRAVENOUSLY ADMINISTERED RADIOISOTOPES. Patricia W. Durbin, C. Willey Asling, Muriel E. Johnston, Joseph G. Hamilton, and Marilyn H. Williams. Nov. 8, 1955. 23p. Contract W-7405-eng-48.

Tracer studies have been performed to study the fate of citrate-complexed high-specific-activity Ce^{144}, Eu^{154}, Tb^{160} and Tm^{170} following intravenous administration. Preliminary investigations of the mode of transport of microgram amounts of these lanthanons complexed with sodium citrate are also described. At a mole ratio of 1000:1 citrate to lanthanon, the distribution is similar to that previously found following intramuscular administration. It is postulated that following the introduction of microgram amounts of lanthanon-citrate into the blood stream, the citrate complex is destroyed and the lanthanon recomplexed by one of the plasma proteins. The distribution studies at postinjection intervals from one minute to 24 hours showed that the rate of disappearance of intravenously administered lanthanons is dependent on the rate of circulation in the target organ; the greater liver deposition of the light lanthanons, and the greater skeletal deposition of the heavy lanthanons are apparent as early as 1 min after intravenous injection; both the liver and the skeleton are capable of accumulating lanthanons against a rather large concentration gradient. The urinary excretion rate of the lanthanons is dependent on the plasma level, i.e., the kidney does not seem to be able to excrete lanthanons against a concentration gradient. (auth)

AEROSOLS

1695   HW-39356
Hanford Atomic Products Operation, Richland, Wash.
MEASUREMENTS OF RELATIVE WIND EROSION OF SMALL PARTICLES FROM VARIOUS PREPARED SURFACES. G. R. Hilst. Oct. 5, 1955. 38p. Contract W-31-109-Eng-52.

Experiments designed to indicate the most suitable soil surfaces in areas where radioactive contamination is likely have been carried out in the Hanford area. Results of two experiments on four different surface conditions are reported. (D.E.B.)

RADIATION EFFECTS

1696   UCRL-3208
California. Univ., Berkeley. Radiation Lab.
MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT [FOR] JULY, AUGUST, SEPTEMBER 1955. Oct. 28, 1955. 32p. Contract W-7405-eng-48.

Data are reported from the following studies: the excretion of injected Sr^{90} in monkeys and their offspring; a comparison of the metabolism of At^{211} and I^{131} in salivaryectomized and thyroidectomized rats; tissue distribution of intravenously administered radiolanthanons in the rat; the radiation chemistry of formic acid and acetic acid; and the effects of radiation on protein systems. Routine health chemistry and health physics activities for the period are summarized. (For preceding period see UCRL-3096.) (C.H.)

1697   USNRDL-TR-66
Naval Radiological Defense Lab., San Francisco.
MODIFICATION OF ACUTE INTESTINAL RADIATION SYNDROME THROUGH SHIELDING. M. N. Swift and S. T. Taketa. Sept. 22, 1955. 18p. Project NM 006 015.

Mortality associated with intestinal injury in rats occurring 3 to 5 days after 1000-r x irradiation was significantly decreased by shielding, during exposure, a small exteriorized section of duodenum or ileum. Protection was not ob-

tained by shielding either the distal half of the cecum or the whole stomach. Effects of concomitant radiation damage to the hematopoietic system were minimized in these experiments by shielding head and thoracic regions in addition to the portion of gastrointestinal tract being investigated. Beginning recovery of radiation-induced small intestine weight loss was observed 4 days after 1000-r irradiation with a section of ileum shielded, whereas no recovery had occurred by this time in non-shielded controls. This effect was not demonstrable at 875 r, a dose that produced no acute intestinal deaths in either control or experimental group. An intermediate dose of 500 r to the ileal section under exposure conditions otherwise identical to the 1000-r exposure resulted in some decrease in the incidence of early deaths but failed to affect intestinal weight significantly as compared with controls with ileal shielding. (auth)

1698

PULMONARY EFFECTS FROM RADIOACTIVE BARIUM SULFATE DUST. H. Cember, T. F. Hatch, J. A. Watson, and T. Grucci (Univ. of Pittsburgh). Arch. Ind. Health 12, 628-34(1955) Dec.

Rats were exposed by intratracheal insufflation to radioactive barium sulfate particles at levels of 4.5 mc., 45μc, and 4.5μc radiosulfur, and were serially killed over a nine-month period. A very small increase in the intensity of inflammation and cicatrization was observed in the animals that received the highest dose. This increase, however, was not considered significant and was not attributed to radiation. It is therefore suggested that the intense radiation dose delivered to the small volume of lung tissue in the immediate vicinity of the barium sulfate particles may not be as hazardous as might be expected or that the latent period for production of serious radiation injury is very much longer than the nine-month period over which these animals were observed. (auth)

1699

ROLE OF THE KIDNEY IN DEVELOPMENT OF VASCULAR HYPERSENSITIVITY FOLLOWING WHOLE BODY IRRADIATION. David F. Bohr, P. A. Rondell, L. E. Palmer, B. L. Baker, and F. H. Bethell (Univ. of Michigan, Ann Arbor). Am. J. Physiol. 183, 331-4(1955) Nov.

Kidney shielding reduces the incidence of increased vascular sensitivity in irradiated rats in the 2nd week postirradiation. Kidney-shielded animals are in better condition than the control animals. It is suggested that the vascular hypersensitivity during this period parallels the incidence of general debility rather than reflects the presence of a renal vasoexcitor material. This interpretation is substantiated by the observation that kidney irradiation fails to increase vascular sensitivity. No histologic change was detected in the irradiated kidney. (auth)

1700

EFFECT OF KIDNEY SHIELDING ON SURVIVAL FOLLOWING WHOLE BODY IRRADIATION. David F. Bohr, P. A. Rondell, L. E. Palmer, and F. H. Bethell (Univ. of Michigan, Ann Arbor). Am. J. Physiol. 183, 335-9(1955) Nov.

A highly significant degree of protection against the lethal effects of whole body irradiation was afforded by shielding the exteriorized kidneys alone in the rat. Even greater protection resulted from shielding superficial structure in the lumbar region of the back. Emphasis is placed on the striking parallelism that exists between the degree of protection observed and that reported in the literature as

resulting from the shielding of diverse isolated structure in the rat. In considering the mechanism by which kidney shielding affords its protection it seemed necessary, therefore, to recognize the possible importance of a nonspecific factor, not associated with the primary physiological functions of the shielded part. Possible protective mechanisms involving specific renal function were also considered. A locally raised strain of Wistar rats proved to be more sensitive to the lethal effects of whole body irradiation than did a commercial strain of Sprague-Dawley rats. (auth)

1701

CINEMICROGRAPHIC OBSERVATIONS AND THEORETICAL CONSIDERATIONS ON REACTIONS OF LYMPHOCYTES TO X-RAYS. Robert Schrek (Veterans Administration Hospital, Hines, Ill.). Radiology 65, 912-19(1955) Dec.

A suspension from the rabbit thymus was irradiated (1,000 r), incubated at 37° C, and photographed and time-lapse cinemicrography. After a short latent period, there developed in the irradiated lymphocyte one or more minute intranuclear vacuoles. Suddenly the cell and its nucleus began to change rapidly in shape. The cell became highly irregular and lobulated and the nucleus showed one or more large vacuoles surrounded by dark rings of chromatin. Finally the vacuole or vacuoles ruptured, with the formation of horseshoeshaped, crescentic, and hemispherical chromatin masses and the development of a pyknotic, fragmented nucleus. Non-irradiated lymphocytes suffered the same degenerative changes, although the onset of degeneration was greatly delayed. The duration of degeneration (from the onset of change in cellular shape to the rupture of the intranuclear vacuole) was approximately the same (twenty minutes) in both the irradiated and the non-irradiated cell. The hypothesis is proposed that radiosensitive cells (lymphocytes and cells in mitotic division) have a specific reversible anabolic-catabolic reaction of desoxyribonucleic acid (DNA). The synthesis is controlled by an enzyme RE, which is radiosensitive. Destruction of RE by irradiation inhibits synthesis and results in the progressive degradation of DNA. Protection against radiation depends on inhibition of inactivation of RE (by cysteine), inhibition of the degradation-synthesis reaction of DNA (by low temperature), or replacement of RE (by spleen shielding). There is some indication that RE is an adenosinetriphosphatase or other phosphatase in the nucleus. (auth)

1702

CONCERNING THE QUESTION OF THE INJURIOUS ACTION OF P^{32} ON OVARIAN TISSUE. K. H. Reiher and G. Lang. Strahlentherapie 98, 453-63(1955) Nov. (In German)

The author made injections of radiophosphorus to albinotic rats. One group received 0.3 μc/g, another group 0.6 μc/g and a third group 1.2 μc/g of P^{32}. He subsequently investigated the morphological changes of the ovaries after various periods of time, namely after 36 hr, 3, 6, 12, and 30 days. Morphological changes were ascertained at a dose of 1.2 μc/g. (auth)

RADIATION HAZARDS AND PROTECTION

1703   K-1071

Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.

THE INHALATION OF RADIOACTIVE MATERIALS AS

RELATED TO HAND CONTAMINATION. J. C. Bailey and
R. C. Rohr. Sept. 15, 1953. Changed from OFFICIAL
USE ONLY Sept. 6, 1955. 18p. Contract W-7405-eng-26.

Tests performed to determine the hazard associated
with the inhalation of radioactive materials as the result
of smoking with contaminated hands indicate that for dry
uranium compounds adhering to the palmar surfaces of
the hands, approximately 1.0% of the material may be
transferred to a cigarette, and that of this approximately
0.2% may appear in the smoke which is inhaled. Most of
the contamination originally placed in a cigarette was
found in the ash, and only 11% of the material was not
recovered following burning; approximately half of this loss
may be attributed to normal losses inherent in the analyti-
cal process, the recovery efficiency for which was found
by supplementary experiments to be 95%. (auth)

1704   NRL-4654
Naval Research Lab., Washington, D. C.
FALLOUT DOSAGES AT WASHINGTON, D. C. I. H.
Blifford, Jr. and H. B. Rosenstock. Oct. 6, 1955. 9p.
Project NR-612-130.

The total infinity dosage at Washington, D. C., due to
fallout of fission product debris from all atomic tests
which took place between January 1951 and May 1955 has
been estimated from the measured air concentration at
ground level. Within order of magnitude accuracy, this
dosage was found to be about 0.2 r. The Nevada tests
contributed about 60% of this amount, and the Russian
tests about 33%, with the remainder due to tests in the
Pacific. Evidence for stratospheric holdup of activity from
the thermonuclear tests of the spring of 1954 has been
found. Fallout of this high altitude activity corresponds
to an infinity dosage of about 0.0002 r. (auth)

1705
EFFECT OF MORPHINE AND N-ALLYLNORMORPHINE
ON RADIATION MORTALITY. Howard L. Andrews and
Ervin J. Liljegren (National Cancer Inst., Bethesda, Md.).
Am. J. Physiol. 183, 322-4(1955) Nov.

Either morphine or nalorphine, given alone prior to
x-irradiation, produces a significant decrease in 28-day
mortality. Although the protective action holds over a
limited range of radiation doses it is of interest because
of the essentially antagonistic actions of the two drugs.
Mixtures of the drugs have little effect on the mortality
statistics. Although the mechanisms of action are un-
known, low oxygen consumption or a depression of
cholinesterase activity cannot account for the results.
(auth)

1706
THE APPLICATION OF EXTERNAL AND INTERNAL
RADIATION EXPOSURE LIMITS. Karl Z. Morgan (Oak
Ridge National Lab., Tenn.). Am. Ind. Hyg. Assoc. Quart.
16, 307-23(1955) Dec.

Units of measurement used for ionizing radiation are de-
defined. Basic criteria for permissible exposures, types
of experimental data needed to establish reliable maximum
permissible exposure values, and administrative problems
in applying maximum permissible exposure values are
reviewed. 23 references. (C.H.)

1707
RADIATION EXPOSURE OF STAFF IN DIAGNOSTIC
PROCEDURES. I. BLOOD COUNTS—RESEARCH OR
ROUTINE? J. F. Loutit (Atomic Energy Research
Establishment, Harwell, Berks, England). Brit. J.
Radiol. 28, 647-50(1955) Dec.

The biological system of monitoring through blood counts
radiation damage on workers occupationally exposed to
ionizing radiation is reviewed. Results obtained with
physical methods of measuring the dose are compared with
results with biological methods. The author concludes that
the leukocytic pattern is not a reliable indicator of biological
damage. (C.H.)

1708
RADIATION EXPOSURE OF STAFF IN DIAGNOSTIC
PROCEDURES. II. RADIATION DOSES RECEIVED BY
DIAGNOSTIC X-RAY WORKERS. S. B. Osborn (Univ. Coll.
Hospital, London). Brit. J. Radiol. 28, 650-4(1955) Dec.

A review of measurements of the radiation dose received
by diagnostic x-ray workers lead to the conclusion that such
workers receive radiation doses well below the maximum
permissible levels, but that they often approach these levels
and occasionally exceed them. (C.H.)

1709
RADIATION EXPOSURE OF STAFF IN DIAGNOSTIC
PROCEDURES. III. SOME ASPECTS OF RADIATION
HYGIENE. W. Binks (Ministry of Health and Medical
Research Council, Sutton, Surrey, England). Brit. J.
Radiol. 28, 654-61(1955) Dec.

Radiation hygiene is defined as the art and science of
protecting human beings from injury by radiation. Topics
discussed include maximum permissible doses for x-ray
diagnostic workers, radiation protection practices in x-ray
diagnostic departments, theoretical estimates of scattered
radiation, measures to reduce the radiation received by x-
ray workers, and measures for the protection of patients
and workers. (C.H.)

1710
PROTECTION MEASURES IN A UNIVERSITY. Titus C.
Evans (State Univ. of Iowa, Iowa City). Radiology 65, 875-
83(1955) Dec.

Radiation safeguards in a university would appear to be
maintained most successfully by rigorous training and self-
discipline, by a willingness on the part of the users to be
extremely cautious in preventing those conditions which
might give rise to either adverse publicity or mental unrest
even though permissible exposure levels are not exceeded.
Supervision may be carried out by routine visits by a
radiation protection officer to each user's laboratory, by
providing a central hot lab, where potentially hazardous
materials are handled in collaboration with members of that
laboratory, or by a combination of the two methods. (auth)

1711
COBALT 60 PROTECTION DESIGN. C. B. Braestrup and
R. T. Mooney (Francis Delafield Hospital, New York).
Radiology 65, 884-91(1955) Dec.

A survey was made on four telecobalt installations and
the structural shielding and other factors affecting protec-
tion are discussed. (C.H.)

1712
RADIATION HAZARD EVALUATION AND CONTROL IN
HOSPITALS. G. Ferlazzo, T. Nicholson, A. Jacobson, and
M. Bushman (Memorial Center, New York). Radiology 65,
892-902(1955) Dec.

The medical use of man-produced radioactive isotopes
and high-energy particle accelerators does not appear to
present any essentially new problem to the radiological
physicist, especially if he is already familiar with the
handling of radium and radon and conventional x-ray
therapy apparatus. Radium and radon and x-rays in

fluoroscopy are still the major sources of external-radiation hazards in hospitals. By comparison, the external hazard from radioactive isotopes is minimal, with the exception of Co^{60} and Au^{198}, used instead of radium and radon. Internal-radiation hazards arising from the medical use of radioactive isotopes also seem to be minimal, or can so be made, if the radiological physicist is familiar with their handling and fully gains the confidence and co-operation of all concerned. All radiation hazards can be minimized, and kept well within the applicable permissible limits without special administrative powers, without experts in new fields, and without unduly elaborate facilities. Much depends on planning and training. Personal aptitudes remain paramount. In some instances, the possible damage to sensitive emulsions and interference with delicate radiation measurements may be more restrictive than the contemplated health hazards. Although our data and conclusions will not always apply in other hospitals, they nevertheless give some idea of hazards that can be expected, practicable control measures, and costs. This knowledge may be helpful in placing the problem of radiation hazards in its proper perspective. The cost of radiation protection in a hospital can be kept within modest limits. (auth)

1713

RADIATION PROTECTION IN THE ATOMIC ENERGY INDUSTRY. A TEN-YEAR REVIEW. H. M. Parker. Radiology 65, 903-11(1955) Dec.

The fundamental problems of radiation protection are precisely those that have perplexed the inquiring radiologist and radiobiologist since radiation sources were first used. The new emphasis introduced by the atomic energy program is the need for solutions to these problems for mixed radiations. In the applied problem and engineering areas, the emphasis is predominantly on the elimination of radioactive contamination and on the interpretation of contamination hazards on the body, within the body, and in many other life forms. It seems to the writer that the next decade will see substantial reduction in the release of effluents to the atmosphere, with some progress in control of in-plant contamination. It appears unlikely that absolute success will be achieved in either field. Therefore, the chief expected burden in radiation protection will probably be in more and more refined interpretation of minimal depositions in man and other life forms. In this way, practical success in control, as opposed to unequivocal success by complete elimination of the problems at source, is the reasonable objective for the next decade. (auth)

RADIOTHERAPY

1714

STUDIES ON RADIOIODINE TREATMENT OF THYRO-TOXICOSIS WITH SPECIAL REFERENCE TO THE BEHAVIOUR OF THE RADIOIODINE TRACER TESTS. Lars-Gunnar Larsson. Acta Radiol. Suppl. 126, 1955. 164p.

The results of radioiodine treatment in a series of hyperthyroid subjects treated from 1951 to 1953 are summarized. An analysis is presented of clinical response to radioiodine tracer tests. The principles of radioiodine treatment and factors of importance to the results are discussed in conjunction with a survey of the literature. 384 references. (C.H.)

1715

SERUM I^{131} FRACTIONATION IN METASTATIC

CARCINOMA OF THE THYROID. THE FATE OF ENDOGENOUS RADIOTHYROXINE AFTER I^{131} THERAPY. Manuel Tubis and Franz K. Bauer (Wadsworth Hosp., Los Angeles and Univ. of California, Los Angeles). Cancer 8, 1115-21(1955) Nov.-Dec.

Athyreotic patients with metastatic thyroid carcinoma were treated with therapeutic amounts of I^{131} (25 to 100 mc per dose), preceded by injections of thyroid-stimulating hormone (TSH). The metastases were demonstrated by scintigrams. Plasma samples were fractionated serially after each dose and the endogenous radiothyroxine measured quantitatively. Endogenous radiothyroxine was found in significant amounts after the first few therapeutic doses. During the course of therapy, endogenous radiothyroxine production by the metastases became inhibited but metastatic lesions could still be demonstrated by scintigram. It is suggested that larger amounts of I^{131} (in excess of 100 mc per dose) be used, since the amounts used in the patients reported here appear to inhibit thyroxine production without interfering with the iodine-accumulating mechanism. (auth)

1716

TREATMENT OF TOXIC ADENOMATOUS GOITER BY LARGE DOSES OF RADIOACTIVE IODINE. James R. Cook, Robert W. Jones, and E. Perry McCullagh (Cleveland Clinic Foundation and Frank E. Bunts Educational Inst., Cleveland, Ohio). J. Clin. Endocrinol. and Metabolism 15, 1512-17(1955) Dec.

Thirty-one patients with toxic adenomatous goiter were treated with a large initial dose of radioactive iodine; in 23 the hyperthyroidism was controlled within four months. Following an initial dose of 50 mc. or more, the hyperthyroidism appeared to be controlled more promptly and effectively than following a smaller initial, or a smaller repeated dose. In no instance was the cardiac status aggravated by treatment. In some patients the initial therapy did not control the hyperthyroidism, but further treatment with radioactive iodine resulted in a euthyroid condition. In others the thyroidal uptake of radioactive iodine was too low, despite persistent thyrotoxicosis, to warrant repeated administration. When treatment other than surgery is to be used in toxic multinodular goiter, radioactive iodine should be given first consideration. (auth)

TOXICOLOGY STUDIES

1717   AF-SAM-55-45
School Of Aviation Medicine, Randolph AFB, Texas.
CATARACT INDUCED BY IODOACETIC ACID. Preliminary Report. Paul A. Cibis and Werner K. Noell. Apr. 1955. 13p.

The clinical and histologic features of cataract induced by iodoacetic acid (20 mg/kg body weight) in adult New Zealand white rabbits are described. The animals included 30 normals, 3 IAA-treated rabbits examined histologically and by slit-lamp biomicroscopy, and 4 IAA-treated rabbits examined histologically only. The cataract formations were observed eight weeks after treatment with IAA. (auth)

TRACER APPLICATIONS

1718   AECU-3079
Hawaii. Univ., Honolulu. Hawaii Marine Lab.
RADIOISOTOPE UPTAKE IN MARINE ORGANISMS WITH

SPECIAL REFERENCE TO THE PASSAGE OF SUCH ISOTOPES AS ARE LIBERATED FROM ATOMIC WEAPONS THROUGH FOOD CHAINS LEADING TO ORGANISMS UTILIZED AS FOOD BY MAN. Annual Report [for] 1954–1955. Sept. 1, 1955. 47p. Contract AT-(04-3)-56.

The uptake from ingestion or from solution, the internal distribution, retention, and biological half-life of Sr^{89} was studied in several genera of fish. These studies indicate that approximately 95% of the oral dose is eliminated in from one to four days, depending upon the species of fish. Of the Sr^{89} remaining in the fish after a few days, about 95% is present in the structural tissues. The biological half-life of Sr^{89} in the internal organs of tuna is less than 24 hr, depending upon the organ, but the half-life of Sr^{89} in the structural tissues is probably in excess of one year. Neither the size of the dose nor repetitive feeding has any effect on the internal distribution or the percentage of the dose retained after several days. In Tilapia, apparently less than 0.1% of the dose is excreted by way of the feces, but this figure is not definitive. Considerably less than one % of the Sr^{89} available in solution was picked up by Carangoides ajax. The total Sr^{89} present in the entire intact fish can be readily determined by monitoring the caudal fin with a portable GM probe. Data are presented on the relationship between organ fresh, dry, and ash weights, to fresh, dry, and ash weights of the entire fish. Radioautographs of fish eyes indicate that the Sr^{89} accumulates in the hyaline cartilage present in the sclera; this and other data presented suggest that cartilage may have a greater avidity for radiostrontium than ossified tissue. (auth)

1719

A HISTOPATHOLOGICAL STUDY OF LYMPH NODES IRRADIATED WITH COLLOIDAL Au^{198}. William M. Christopherson and Harold F. Berg (Univ. of Louisville School of Medicine and Louisville Medical Center, Kentucky). Cancer 8, 1261-9(1955) Nov.-Dec.

A histopathological study of 377 lymph nodes irradiated by injecting radiogold, Au^{198}, into the afferent lymphatics was made. Autoradiograms were prepared to study intranodal distribution of the isotope. The intranodal changes varied considerably and were dependent on the length of irradiation exposure, the magnitude of the radioactivity used, and the proximity of the injection site to the lymph nodes. The changes differed quantitatively but not qualitatively from those found in nodes irradiated by other methods. The intranodal distribution and radiation change was usually of a patchy nature. Only when large dosages of from 50 to 85 mc were used was there a tendency toward total or near-total nodal destruction. This amount of radioactivity was not tolerated well at the site of injection. The inability to control the distribution of the isotope within the regional lymph nodes would appear to be a major obstacle to the effectiveness of this method of delivering selective ionizing radiations. (auth)

CHEMISTRY

1720   AECU-3064

Pennsylvania State Univ., University Park. Mineral Industries Experiment Station.
THE BENEFICIATION OF FLORIDA PHOSPHATE

LEACHED-ZONE MATERIAL. H. B. Charmbury, D. R. Mitchell, Vincent I. Purcell, Robert E. Snow, John D. Warfel, Robert L. Jones, and Louis T. Pugliese. July 1, 1955. 195p. Project No. G-32. Contract AT(49-6)-919.

This report consists of Progress Reports Serial Nos. 1 through 6.

As a result of the work performed on the beneficiation of Florida phosphate leached-zone material, it may be concluded that: 1. This material can be beneficiated by dry methods without any serious materials handling difficulties. The run-of-mine material can be dried in a direct fired rotary-type drier, attritionally ground in an air-swept cylindro-conical ball mill, and air-classified in a gyrotor or cascade-type separator to produce a concentrate consisting primarily of minus 200 mesh particles and a tailing of particles primarily in the size range of 14×200 mesh. Yields of concentrate will amount to about 35% of the dried run-of-mine material and grades of P_2O_5 and U_3O_8 will be approximately doubled. Recoveries of P_2O_5 and U_3O_8 will range from 50 to 70% depending upon the original grades. 2. The 14×200 mesh tailings from a dry beneficiation process can be theoretically upgraded by wet beneficiation processes based on gravity concentration methods. Yields of about 15% of the tailing material with grades of P_2O_5 and U_3O_8 comparable to those produced by the dry beneficiation process may be obtained to raise the overall recoveries of P_2O_5 and U_3O_8 to a range of 60 to 90%, depending upon the original ore. Details of all of the work and specific conclusions concerning the analytical, drying, grinding, air-classification, and gravity concentration characteristics of the leached-zone material are found in Progress Reports Serial No's. 2, 3, 4, 5, and 6, respectively. (auth)

1721   MCC-1023-TR-169

Utah. Univ., Salt Lake City.
THERMODYNAMIC DATA AND BOND ENERGIES FOR SOME BORON COMPOUNDS. Final Technical Report. Douglas H. Pack and George Richard Hill. June 1955. 69p. [For Olin Mathieson Corp. Contract NOa(s)-52-1023-c].

The thermodynamic functions C_p^0, $H^0-H_0^0$, S^0, $-(F^0-H_0^0)/T$, log Kf, ΔFf^0, and ΔHf^0 have been calculated and tabulated at selected temperatures for which data were available within the range 25 to 2000°K for the following elements and compounds: crystalline boron, amorphous boron, H_2, F_2, diborane-6, pentaborane-9, decaborane, boron trifluoride, boron trichloride, boron tribromide, hydrogen fluoride, lithium borohydride, sodium borohydride, boric oxide, boric acid, lithium oxide, hydrazine, boron nitride, and dimethyl-amino-diborane. Methods of calculation are presented. Methods of obtaining bond-energies are discussed. The difference between bond-energy and bond-dissociation-energy is discussed and illustrated. Theoretical and semi-empirical considerations relating bond-distance and bond-order are combined with semi-empirical relations between bond-energy and bond-order to yield bond-energy as a function of bond-distance. (See also MCC-1023-TR-82.) (auth)

1722   MCC-1023-TR-170

Utah. Univ., Salt Lake City.
KINETICS OF CONVERSION OF DIBORANE IN AN INFRARED CELL. Final Technical Report for period ending June 30, 1955. John R. Morrey, Dean G. Wilson, Douglas

H. Pack, and George Richard Hill. June 1955. 13p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

Descriptions of equipment to be used in the study of the pyrolysis of diborane are presented. These units include vacuum system, pressure-reading device, and infrared cell. (C.W.H.)

1723   MCC-1023-TR-174
Michigan State Univ., East Lansing.
THE PRODUCTION OF REDUCED BORON COMPOUNDS AND BORON HYDRIDES (thesis). Pearl Rexford Ogle, Jr. June 1955. 95p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

The preparation of reduced boron compounds by the electrolytic reduction of alkyldifluoroboranes in non-aqueous solvents and by the reactions of boron compounds with trimethoxyboroxine was investigated. Physical and chemical properties of several alkyldifluoroboranes and alkoxyboroxines were determined. (C.W.H.)

1724   MCC-1023-TR-177
Delaware. Univ., Newark.
THE SORPTION OF BORON COMPOUNDS (thesis). Klaus Robert Lange. Nov. 1955. 65p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

Data are presented for the sorption of diborane, B_2H_6, on cocoanut charcoal, Pd black, silica—alumina, and other sorbents. Sorption data for deutero-diborane and trimethyl borane are also included. The effect of surface-active agents on the pyrolysis of B_2H_6 was studied. (C.W.H.)

1725   MCC-1023-TR-178
Washington. Univ., Seattle.
EQUILIBRIA AND KINETICS AMONG SUBSTITUTED DIBORANES. Final Report. D. M. Ritter. June 1955. 38p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023c].

The preparation of alkenyl borines by the dehydrohalogenation of haloalkyl borines and by the reaction of alkali metal alkenyls with partially alkylated boron halides was investigated. Methylvinylborines and methylpropenyl-borines have been prepared by the latter reaction. The effects of polymerization and disproportionation on the yields are discussed. (C.W.H.)

1726   NBS-4161
National Bureau of Standards, Washington, D. C.
IDEAL GAS THERMODYNAMIC FUNCTIONS OF THE ISOTOPIC HYDROGEN CYANIDES. Joe C. Bradley, Lester Haar, and Abraham S. Friedman. Dec. 15, 1955. 13p. NBS Project 0302-10-2641.

The ideal gas thermodynamic functions for HCN, DCN, and TCN were calculated from molecular data. The zero frequencies of TCN were obtained by a normal coordinate treatment. The partition functions are obtained in closed form. The calculations include high-temperature corrections for vibrational anharmonicity, rotation-vibration coupling, centrifugal stretching, and azimuthal quantum effects, and low-temperature corrections for non-classical rotation. The statistical calculations were performed on the National Bureau of Standards digital computer—SEAC. Tables of C_p^0/R, $(H^0-E_0^0)/RT$, $-(F^0-E_0^0)/RT$, and S^0/R have been calculated at small temperature intervals from 50 to 5000°K. (auth)

1727   NP-5842
Pennsylvania State Univ., University Park.
COORDINATION POLYMERS. Bimonthly Progress Report No. 5 [for] August 1, 1955 to September 30, 1955. Dept. of Chemistry. W. C. Fernelius, N. R. Garofano, D. E. Goldberg, D. F. Martin, and F. D. Thomas, II. 15p. Contract AF33(616)-2742.

A series of compounds of the type $(RCO)_2CH(CH_2)_nCH(COR)_2$ is being prepared in order to determine the effect of n on the solubility and plastic character of the resulting ploymers. The compounds where $R = CH_3$ and $n = 0$, 1, and 2 have been prepared. Reaction products of zirconium acetylacetonate with sebacoyldiacetophenone and 1,1,4,4-tetraacetylbutane and of a mixture of zirconium and beryllium acetylacetonates with the two bis(β-diketones) two unsaturated β-diketones 2,4-tetradecene-6, 8-dione, and 5-phenyl-1-pentene-3,5-dione, have been prepared. Effort to prepare polymers from bifunctional Schiff bases and metal ions as well as those from phosphorus acids and cobalt complexes continue to be unpromising. (auth)

1728   NYO-3920
Tufts Univ., Medford, Mass.
CONSIDERATION OF THE NATURE, FORMATION AND DENSITY OF HYDRIDES: PART I. A NAIVE APPROACH TO THE CALCULATION OF DENSITY OF CRYSTALLINE SOLIDS, PARTICULARLY HYDRIDES. Thomas R. P. Gibb, Jr. Nov. 17, 1954; PART II. FURTHER CONSIDERATION OF THE NATURE, FORMATION AND DENSITY OF METALLIC HYDRIDES. Thomas R. P. Gibb, Jr. Mar. 17, 1955; PART III. METALLIC HYDRIDES AND THE HYDRIDE ANION THEORY. Thomas R. P. Gibb, Jr., and George G. Libowitz. May 17, 1955. Progress Report on the Preparation and Properties of Metal Hydrogen Systems. 56p. Contract AT(30-1)-1350.

A new method is described for estimating the density of saline binary hydrides and requires knowledge only of crystal structure, type, and molecular weight. The relationship between the properties of a metal and the density of its hydride is discussed. The effective radius of hydrogen is recalculated for several hydrides. (For preceding period see NYO-3819.) (C.W.H.)

1729   UCRL-3157
California. Univ., Berkeley. Radiation Lab.
CHEMISTRY DIVISION QUARTERLY REPORT [FOR] JUNE, JULY, AUGUST 1955. Sept. 30, 1955. 85p. Contract W-7405-eng-48.

Bio-organic Chemistry. The free energies of reactions in the carbon-reduction cycle and of formation of intermediates in the cycle are tabulated. The distribution of 6-thioctic acid in algae has been determined. The ultra-violet-adsorption spectra of ribulose diphosphate are reported. Studies were continued on the light-emission effect on photosynthesis, catalytic action of carboxydismutase, metabolic intermediates in algae, brain chemistry and adaptive behavior, respiratory C^{14} patterns in rats given labeled acetates, and radiation decomposition of choline analogs. The synthesis of thioctic-S^{35}_2 acid is described. Nuclear Chemistry. Spin assignments are reported for Ra^{222} and Ra^{226}. Gamma spectra are reported for Th^{221}, Rn^{219}, and Po^{215}. Decay schemes are presented for Bi^{203}, Bi^{204}, Bi^{205}, Np^{239}, and Re^{183}. The metastable states of U^{230}, Po^{208}, Po^{209}, and Am^{243} were investigated. Alpha spectra of At^{209}, Th^{230}, and Pa^{231} are reported. The half life of Pu^{242} is calculated to be 3.6×10^5 yr. The yields for the reaction products of Ta with 5.7-Bev protons were measured. Spallation-excitation functions for the α-particle induced reaction of U^{233} and for deuteron induced reactions of Pu^{239} and Pu^{240} are presented. The crystal

structure of $BaTi_4O_9$ has been determined. A formula is proposed for calculating the growth of successive members in a chain of nuclear transformations. The theoretical calculations of nuclear properties by use of spheroidal wave functions are discussed. The color centers and phosphorescence in $EuCl_2$ and $LaCl_3$ were investigated. General Chemistry. Studies were continued on the radiation chemistry and photochemistry of diphenylpicryl-hydrazyl (DPPH) in non-aqueous solvents. The synthesis of acetaldehyde-t, is reported. (For preceding period see UCRL-3068.) (C.W.H.)

1730 WADC-TR-55-90

Southwest Research Inst., San Antonio.
LITERATURE SURVEY OF LOW MOLECULAR WEIGHT POLYNUCLEAR AROMATIC COMPOUNDS. Charles F. Raley, Jr. May 1955. 300p. Project title: RUBBER, PLASTICS AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF33(616)-276.

A literature search was carried out covering the field of low molecular weight, polynuclear, aromatic compounds with the object of determining the usefulness of such compounds as high-temperature lubricants. The highest literature boiling point, calculated atmospheric boiling point, melting point, and literature reference are given. Recommendations are made as to the compounds or types of compounds which appear promising as high-temperature lubricants. (auth)

1731 AEC-tr-2360

THE SYSTEM SODIUM HYDROXIDE–SODIUM NITRATE– WATER. E. Janecke. Translated by K. S. Bevis from Z. anorg. u allgem. Chem. 188, 72-80(1930). 19p.

Phase studies of the $NaOH-NaNO_3-H_2O$ system are reported. Two double salts, $2NaOH \cdot NaNO_3$ and $NaOH \cdot NaNO_3$, and an eutectic, $NaOH-NaOH \cdot H_2O-2NaOH \cdot NaNO_3$ were observed. (C.W.H.)

1732

RHENIUM COMPLEX WITH DIMETHYLGLYOXIME. A. I. Lazarev. (Kuibyshev Indust. Inst.) Zhur. Obshchei Khim. 25, 2198-2204(1955) Nov. (In Russian)

The physico-chemical and ionic chromatographic methods were applied in the study of rhenium complex with dimethyl-glyoxime. The complex formula of the $[ReOH_2Dm]Cl_2$, formed in the hydrochloric acid medium in the presence of tin chloride was suggested. (R.V.J.)

1733

MASS TRANSFER — TRANSPORT PROPERTIES. F. J. Van Antwerpen, ed. Chem. Eng. Progr. 51, Symposium Ser. No. 16, 1955. 120p.

A collection of papers with the following titles is presented: Mass Transfer at Rotating Cylinders; Mass Transfer between Liquid Drops and a Continuous Liquid Phase in a Countercurrent Fluidized System: Liquid-Liquid Extraction in a Spray Tower; Size and Mass Transfer Studies of Gas Bubbles; Simultaneous Heat and Mass Transfer in a Nonisothermal System: Through-Flow Drying in the Low-Moisture Range; Gas-Film Mass Transfer in a Packed Column; Fluid Mechanics and the Transport Phenomena; Thermal Diffusion in Liquids; Viscosity of Gases and Gas Mixtures at High Pressures; and Mass Transfer Inside Drops in a Gas. (M.P.G.)

1734

THE OSMOTIC AND ACTIVITY COEFFICIENTS OF

AQUEOUS SOLUTIONS OF THORIUM CHLORIDE AT 25°. R. A. Robinson (Univ. of Malaya, Singapore). J. Am. Chem. Soc. 77, 6200(1955) Dec. 5.

Isopiestic measurements of $ThCl_4$ solutions and calculated osmotic and activity coefficients at 25°C are tabulated. It appears that $ThCl_4$ has higher osmotic coefficients than $Th(NO_3)_4$. (C.W.H.)

1735

PREPARATION AND CHLORINATION OF TITANIFEROUS SLAG FROM IDAHO ILMENITES. Alva H. Roberson and Lloyd H. Banning (U. S. Bureau of Mines, Albany, Oreg.). J. Metals 7, 1335-42(1955) Dec.

A magnesite-lined furnace proved to be more satisfactory for smelting ilmenite in a continuous dry top electric smelting operation than did a carbon-lined furnace. Smelting tests indicated that titaniferous slag products containing 80 to 83% TiO_2 could be consistently produced without the use of flux in the furnace charge, providing the reductant consisted of proper proportions of wood chips and coke. The addition of a MnO ore to the smelting charge had definite beneficial effects in displacing iron from the slag product. Electric furnace slags containing 80 to 85% TiO_2 chlorinated readily to produce an acceptable commercial grade of $TiCl_4$. A final product containing 94% TiO_2 can be produced by chlorinating the slag directly, without C, followed by water leaching to remove iron and Mn chlorides. (auth)

1736

DETERMINATION OF THE DIFFUSION COEFFICIENT OF SILVER IONS IN SILVER BROMIDE BY THE METHOD OF REMOVING THIN LAMINAS. S. N. Banasevich, B. G. Lur'e, and A. N. Murin. Zhur. Tekh. Fiz. 25, 2277-9(1955) Nov. (In Russian)

The mechanisms of self-diffusion and ion conductivity for silver bromide have been proven to be identical in structurally insensitive high-temperature areas. (R.V.J.)

Refer also to abstract 1817.

ANALYTICAL PROCEDURES

1737 IDO-14357

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
DETERMINATION OF ALUMINUM IN PRESENCE OF FLUORIDE, ZIRCONIUM, AND URANIUM. Bernice E. Paige, Maxine C. Elliott, and James E. Rein. Nov. 22, 1955. 9p. Contract AT(10-1)-205.

A method is described for the determination of Al in samples containing large amounts of fluoride, Zr, and U. Fluoride is removed by a single sulfuric acid fuming. The resulting residue is heated with excess sodium hydroxide which dissolves the amphoteric Al. After adjustment of pH, excess K fluoride is added which complexes the Al releasing hydroxyl ions proportional to the Al concentration. These are titrated with standard acid back to the adjusted pH. The only major interferences are metals complexed by fluoride which are either amphoteric or have soluble hydroxides at high pH. (auth)

1738 KAPL-1444

Knolls Atomic Power Lab., Schenectady, N. Y.
THE DETERMINATION OF CARBON IN SODIUM. L. P. Pepkowitz and J. T. Porter, II. Nov. 28, 1955. 17p. Contract W-31-109-Eng-52.

The determination of carbon in sodium at low concentrations is required by the observation that grain-boundary carbonization sometimes occurs in heat exchange systems utilizing sodium as the liquid metal coolant. The method involves the conversion of the sodium to the sulfate, wet oxidation of the carbon to carbon dioxide, and the measurement of the low concentrations of carbon dioxide by a volumetric, differential freeze-out technique. The procedure is simplified by the observation that in heat transfer systems only elemental carbon is present. The method is accurate with a standard deviation for precision of ±0.001%. (auth)

1739   LA-1947

Los Alamos Scientific Lab., N. Mex.

DETERMINATION OF CARBON IN URANIUM TETRA-FLUORIDE. Edward H. Van Kooten and Ross D. Gardner. Jan. 1951. 23p. [Contract W-7405-eng-36].

A procedure is described wherein carbon in uranium tetrafluoride is determined quantitatively by burning the sample in a stream of oxygen at a temperature of 1100 to 1200°C. The fluorine is removed from the combustion gases by passing the latter through specially-treated granular magnesium oxide at the combustion temperature. The carbon dioxide formed in the combustion process is weighed after being collected in an absorption tube filled with Ascarite and Anhydrone. Twenty-eight determinations made on a batch of UF_4 averaging 123 ppm of C gave a standard deviation of 7.8, and 16 determinations of UF_4 averaging 16 ppm of C gave a standard deviation of 4.9 ppm. (auth)

1740   MIT-1110

Massachusetts Inst. of Tech., Cambridge. Metallurgical Project.

PROPOSED TENTATIVE STANDARD CHEMICAL METHODS OF ANALYSIS FOR THE DETERMINATION OF IMPURITIES IN ZIRCONIUM. E. B. Read, Helen M. Lawler, and W. A. Davis. Mar. 10, 1953. Decl. Oct. 6, 1955. 79p. Contract AT(30-1)-981.

Standard procedures are presented for the chemical analysis of commercial-grade Zr for trace quantities of Al, B, Cd, C, Cl, Cr, Cu, Fe, Pb, Mg, Mn, Mo, Ni, N, O, P, Si, Ti, W, V, and Zn. (C.W.H.)

1741

EMISSION SPECTROMETRIC DETERMINATION OF LOW PERCENTAGES OF ZIRCONIUM IN HAFNIUM. Linsley S. Gray, Jr. and Velmer A. Fassel (Iowa State Coll., Ames). Anal. Chem. 28, 18-21(1956) Jan.

Emission spectrometric procedures are described for the determination of zirconium in hafnium in the ranges 0.001 to 0.2% using conventional d-c carbon arc excitation and 0.01 to 0.5% using the conducting briquet excitation technique. (auth)

1742

4-METHYL- AND 4-ISOPROPYL-1,2-CYCLOHEXANE-DIONEDIOXIME. GRAVIMETRIC REAGENTS FOR NICKEL AND PALLADIUM. Charles V. Banks and Donald T. Hooker (Iowa State Coll., Ames). Anal. Chem. 28, 79-81 (1956) Jan.

Since it is somewhat inconvenient at the present time to synthesize seven-membered alicyclic vic-dioximes, it seemed desirable to study the more easily prepared substituted-1,2-cyclohexanedionedioximes as analytical reagents. 4-Methyl-1,2-cyclohexanedionedioxime was found to be an excellent reagent for the gravimetric deter-

mination of both nickel and palladium. It is water-soluble, quantitatively precipitates nickel at pH 3, forms a precipitate free from contamination of excess reagent which filters easily and does not creep, and has a high equivalent weight. 4-Isopropyl-1,2-cyclohexanedionedioxime, while being somewhat less soluble in water, is especially useful for the determination of small amounts of nickel and palladium. (auth)

1743

EFFECT OF pH ON HIGH-SALT—THORIUM FLUORIDE TITRATION. Donald F. Adams and Robert K. Koppe (Washington State Inst. of Tech., Pullman). Anal. Chem. 28, 116-17(1956) Jan.

Variations in pH of the final titration solution are shown to increase the variability with which microgram quantities of fluoride may be determined. A graphic correction of the observed titration volume based upon the pH of the final titration solution increases the precision of the method. The effect of small changes in pH of the final titration solution is also reduced by conducting the titration at 2.90 instead of at 2.70 as previously recommended. (auth)

1744

DETERMINATION OF THORIUM AND URANIUM CONCENTRATION RATIOS OF INDIAN ROCKS AND MINERALS. V. Seetharam Aithal (Indian Inst. of Sci., Bangalore). J. Sci. Ind. Research (India) 14B, 519-23(1955) Oct.

Thorium—uranium concentration ratios in ten samples of rocks and minerals have been determined by estimating the range of the α-particles emitted by thorium and uranium with a scintillation counter. The method of measurement and the characteristics of scintillation counter employed are described. (auth)

1745

COLORIMETRIC ESTIMATION OF CERIUM WITH SODIUM PYROCATECHOL DISULPHONATE. B. Sarma (National Chemical Lab. of India, Poona). J. Sci. Ind. Research (India) 14B, 538-9(1955) Oct.

Cerium ions, Ce^{4+}, react with Tiron (sodium 1,2-dihydroxybenzene-3,5-disulfonate) in neutral or alkaline solutions to form a stable and soluble violet-colored complex which exhibits maximum adsorption at 500 mμ. Concentrations of Ce in the range 0.4 to 100 ppm may be determined with an error of less than 2%. Cations which may interfere include UO_2^{2+}, Fe^{3+}, Nb^{5+}, Ti^{4+}, and Ta^{5+}. (C.W.H.)

1746

RADIOACTIVATION ANALYSIS OF PHOSPHORUS IN SILICON. J. A. James and D. H. Richards (British Thomson-Houston Co., Ltd., Rugby). Nature 176, 1026 (1955) Nov. 26.

A technique is described for estimating submicrogram quantities. (D.E.B.)

1747

MANUAL OF ANALYTICAL METHODS FOR THE DETERMINATION OF URANIUM AND THORIUM IN THEIR ORES (Sept. 1950 (Revised Apr. 1955)). New Brunswick Lab. Washington, U. S. Government Printing Office, 1955. 51p. $0.25.

A compilation of chemical methods for the determination of U and Th in pitchblende, carnotite-bearing sandstone, phosphate rock, and monazite sands is presented. (J.E.D.)

1748

NEW METHODS IN ANALYTICAL CHEMISTRY. Ronald

Belcher and Cecil L. Wilson. New York, Reinhold Publishing Corp., 1955. 287p.

Selected laboratory experiments are presented for the demonstration of separation procedures involving precipitation or extraction steps. The preparation and application of inorganic precipitants, organic reagents, indicators, and titrating agents are described. Miscellaneous procedures for the titrimetric determination of several elements are included. (C.W.H.)

DEUTERIUM AND DEUTERIUM COMPOUNDS

1749

DEUTERIUM EXCHANGE BETWEEN TRICHLORO-ETHYLENE AND WATER. INFRARED SPECTRAL DATA FOR TRICHLOROETHYLENE-D. Thomas J. Houser, Richard B. Bernstein, Richard G. Miekka, and John C. Angus (Univ. of Michigan, Ann Arbor). J. Am. Chem. Soc. 77, 6201-3(1955) Dec. 5.

Measurements of the exchange rate of C_2Cl_3H with NaOD in D_2O and of the reverse exchange of C_2Cl_3D with NaOH are reported. The exchanges appear to be first order and half-times were found to be 50 hr and 60 hr, respectively. Infrared spectra are presented for C_2Cl_3H and C_2Cl_3D. (C.W.H.)

FLUORINE AND FLUORINE COMPOUNDS

1750   WADC-TR-52-197(Pt.5)
Minnesota Mining and Mfg. Co., St. Paul.
SYNTHETIC RUBBERS FROM CARBON–FLUORINE COMPOUNDS. Covers period of work from May 15, 1954 to April 15, 1955. Frank A. Bovey. July 1955. 68p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: COMPOUNDING OF ELASTO-MERS. Contract AF33(038)-515.

Studies were continued on fluoroacrylate polymers and copolymers. Improvements have been attempted in copolymerization with fluorinated dienes, by incorporation of plasticizers, and by addition of heat stabilizers. (For preceding period see WADC-TR-52-197(Pt.4).) (auth)

1751

ELECTROCHEMICAL FLUORINATION OF INORGANIC COMPOUNDS. ANODIC STRUCTURE OF SULFURYL FLUORIDE. Hans Schmidt and Hermann Dietrich Schmidt. Z. anorg. u. allgem. Chem. 279, 289-99(1955) July. (In German)

Refer also to abstract 1739.

MOLECULAR STRUCTURE

Refer to abstract 1693.

RADIATION CHEMISTRY

Refer to abstract 1770.

RARE EARTHS AND RARE-EARTH COMPOUNDS

1752   AD-48382
Brooklyn. Polytechnic Inst.
LATTICE II. Quarterly Report No. 3 Covering the Period February 1, 1954 to April 30, 1954. E. Banks.

May 18, 1954. 54p. DA Project No. 3-99-15-022. Contract DA-36-039-Sc-42582.

New ferromagnetic phases with the probable composition $M_{1/2} La_{1/2} Fe_{12}O_{19}$, (where M = Na, K, Rb), have been prepared. No Li or Cs analogues appear to exist. The x-ray patterns of these new phases appear to be quite similar to the pattern of $BaO \cdot 6Fe_2O_3$. Resistivity and Hall effect measurements have been made on specimens cut from a large single crystal of cadmium selenide. The resistivity-temperature curves between liquid nitrogen temperature and 100°C show behavior similar to that expected of degenerate n-type semiconductors, the resistivity increasing with time in contact with Se vapor, and decreasing on heating in Cd vapor. Hall effect measurements at room temperature indicate that all samples are n-type, with the number of carriers generally increasing with heating in Cd vapor and decreasing with heating in Se vapor. The number of conduction electrons ranged from 3×10^{17} to 4×10^{18} cm^{-3}. (auth)

1753

THE LANTHANUM–TITANIUM–OXYGEN SYSTEM. Michael Kestigian and Roland Ward (Univ. of Connecticut, Storrs). J. Am. Chem. Soc. 77, 6199-6200(1955) Dec. 5.

The preparation and crystal structure of the lanthanum titanium oxide, $La_{(2/3 + x)}TiO_3$, where x has values from 0 to $1/3$, are described. The oxide has a deformed Perovskite structure and is analogous to the sodium tungsten bronzes. (C.W.H.)

Refer also to abstracts 1745 and 1755.

SEPARATION PROCEDURES

1754   AWRE-O-12/55
Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.
THEORETICAL AND PRACTICAL CONSIDERATIONS OF THE PURIFICATION OF BERYLLIUM BY DISTILLATION. A. J. Martin. May 20, 1955. 27p.

Methods of purification by distillation are used to obtain sufficiently pure beryllium to prove its limited but definite ductility similar to that of titanium and zirconium. Diagrams and tabulations of the distillation procedures are given. 22 references. (R.V.J.)

1755   ISC-617
Ames Lab., Ames, Iowa.
BASIC PRINCIPLES INVOLVED IN THE MACRO-SEPARATION OF ADJACENT RARE EARTHS FROM EACH OTHER BY MEANS OF ION EXCHANGE. J. E. Powell and F. H. Spedding. Oct. 26, 1955. 28p. Contract W-7405-eng-82.

The separation of rare earth mixtures by ion exchange using ammonium ethylenediaminetetraacetate as an eluting agent and cupric ion as a retaining cation has been discussed in detail. Simple counter-current separation theory has been used to predict the minimum number of displacements of an adsorbed band that are necessary in order to separate the components of a binary mixture. It has been shown how the theory can be applied to even more complex systems and experimental data have been presented for some of the more difficultly separable groups of rare-earth species. (auth)

1756

THEORY OF CHROMATOGRAPHY. PART 10.

FORMULAE FOR DIFFUSION INTO SPHERES AND THEIR APPLICATION TO CHROMATOGRAPHY. E. Glueckauf (Atomic Energy Research Establishment, Harwell, Berks, England). Trans. Faraday Soc. 51, 1540-51(1955) Nov.

A mathematical analysis of the diffusion process and the practical application of several diffusion equations to ion exchange and chromatography are discussed. (C.W.H.)

1757

CALCULATION METHODS FOR TRANSFER COLUMNS. S. Villani. Energia nucleare (Milan) 2, 504-18(1955) Oct. 15. (In Italian)

The performance of various types of countercurrent separation columns for deuterium separation has been studied with respect to the flow conditions in order to establish the common characteristics of the columns. A transfer fraction is defined, which is advantageously applicable in many calculations. As an example, the calculation of the separation factor for a dual-temperature separating element is shown. The definition of the yield of a column is more convenient in other cases. By the use of this quantity, the optimal distribution of deuterium recovery units has been stated in a four stage electrolytic plant. (auth)

Refer also to abstracts 1749, 1761, 1762, 1767, and 1923.

SYNTHESES

1758

BENZENE-$^{14}C_1$ FROM THE NEUTRON IRRADIATION OF THE CLATHRATE WITH AMMONIACAL NICKEL CYANIDE. Alfred P. Wolf, Carol S. Redvanly, and R. Christian Anderson (Brookhaven National Lab., Upton, N. Y.). Nature 176, 831(1955) Oct. 29.

Benzene-C^{14} has been produced by neutron irradiation of the clathrate of ammoniacal nickel cyanide and benzene. Of the total C^{14} activity produced in the samples, 1.4% was found in the benzene. (C.W.H.)

TRACER APPLICATIONS

1759

DEUTERIUM ISOTOPE EFFECT ON THE AQUATION AND HYDROLYSIS RATES OF AQUEOUS $[Co(NH_3)_5Cl]^{+2}$ AND $[Co(NH_3)_5Br]^{+2}$. Arthur W. Adamson and Fred Basolo (Technical Univ. of Denmark, Copenhagen). Acta Chem. Scand. 9, No. 8, 1261-74(1955).

The hydrolysis of $[Co(NH_3)_5Cl]^{2+}$ and the aquation of this and of $[Co(NH_3)_5Br]^{2+}$ have been studied in both ordinary and in d-containing aqueous systems. The hydrolysis rate in heavy water was some 60% of that in ordinary H_2O, an effect due primarily to a lower frequency factor. The aquation rates were similarly lower in d-containing systems systems, and, because of the slow exchange between complex and solvent in acid media, it was possible to observe the four possible aquation rates corresponding to light or heavy complex in light or heavy solvent. From a consideration of the deuterium effect and also the large entropy of activation, 37 e.u., as well as of other aspects, it is concluded that the hydrolysis proceeds through an acid base pre-equilibrium. For the aquation reaction, an explanation of the deuterium effects is given, involving a "front side" replacement by water, facilitated by hydrogen bond bridges. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

1760   LA-1913

Los Alamos Scientific Lab., N. Mex.
STUDIES ON THE PREPARATION, PROPERTIES, AND COMPOSITION OF PLUTONIUM PEROXIDE. J. A. Leary. Dec. 1954. 38p. [Contract W-7405-eng-36].

Two distinct crystalline structures of plutonium peroxide have been prepared. Face-centered cubic peroxide (a = 16.46 A) has been precipitated from various mineral acid solutions at low acidities. At higher acidities (~3M) a pure hexagonal structure was obtained. Both structures are plutonium(IV) compounds. Preparation methods, chemical analyses, and the general properties of both structures have been determined. (auth)

1761

COMBINATION OF UNIT PROCESSES FOR ISOLATING PLUTONIUM. Jan Rydberg and Lars Gunnar Sillén (Research Inst. of National Defence, Sundbyberg, Sweden and Royal Inst. of Tech., Stockholm). Acta Chem. Scand. 9, No. 8, 1241-51(1955).

The unit processes, reduction-oxidation and separation, which have been compiled from various laboratory and industrial methods used for the separation of Pu from irradiated U and the corresponding flow sheets are discussed. (C.W.H.)

1762

TWO METHODS FOR THE ISOLATION OF TRACER AMOUNTS OF PLUTONIUM. Jan Rydberg (Research Inst. of National Defence, Sundbyberg, Sweden). Acta Chem. Scand. 9, No. 8, 1252-60(1955).

A modified bismuth phosphate carrier method and a sulfide precipitation method are outlined for the separation of trace quantities of Pu from neutron-irradiated U (irradiation time—1 yr, cooling time—3 mo.). The relative yields and activities of fission products produced in the U samples are tabulated. (C.W.H.)

1763

CHLORIDE COMPLEXING AND DISPROPORTIONATION OF PU(IV) IN HYDROCHLORIC ACID. S. W. Rabideau and H. D. Cowan (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 77, 6145-8(1955) Dec. 5.

It has been shown from measurements of the formal potentials of the $Pu^{3+}-Pu^{4+}$ couple in $HCl-HClO_4$ solutions at constant total acidity and ionic strength that the complex ion $PuCl^{3+}$ is formed. The dissociation quotient of this complex at 25° has been found to be 1.77 ± 0.10 at unit ionic strength and 1.70 ± 0.03 at an ionic strength of two. At 25° in molar hydrochloric acid the thermodynamic quantities for the reaction $PuCl^{3+} \rightleftharpoons Pu^{4+} + Cl^-$ are $\Delta F = -0.34$ kcal/mole, $\Delta H = -1.9$ kcal/mole and $\Delta S = -5$ eu. Equilibrium and rate measurements were made in hydrochloric acid solutions at 6, 25, 35, and 45° in a study of the disproportionation reaction $3Pu^{4+} + 2H_2O \rightleftharpoons 2Pu^{3+} + PuO_2^{2+} + 4H^+$. In accord with this reaction, a fourth power hydrogen ion dependence of the equilibrium quotient was observed. The disproportionation reaction rate constant exhibited an inverse third power dependence upon the hydrogen ion concentration. Values of 39 kcal/mole and 53 eu. were obtained for the heat of activation and for the entropy of activation, respectively, for the disproportionation reaction in molar hydrochloric acid. The change in the heat content at 25° for the reaction $Pu^{3+} + H^+ \rightleftharpoons Pu^{4+} + \frac{1}{2}H_2$ was calculated to be 14.32 kcal/mole in molar hydrochloric acid and 13.63

kcal/mole in molar perchloric acid from measurements of the formal potential of the $Pu^{3+}-Pu^{4+}$ couple as a function of temperature. The $Pu^{3+}-PuO_2^{2+}$ potential in molar hydrochloric acid was calculated from the measured $Pu^{3+}-Pu^{4+}$ formal potential and from the disproportionation equilibrium quotient at each temperature. For the reaction $Pu^{3+} + 2H_2O \rightleftharpoons PuO_2^{2+} + H^+ + 3/2H_2$ in molar hydrochloric acid at 25°, $\Delta F = 70.8$ kcal/mole, $\Delta H = 78.4$ kcal/mole and $\Delta S = 25.4$ eu. The ionic entropies of PuO_2^{2+} and Pu^{4+} have been calculated to be -28.9 and -87 eu., respectively. (auth)

1764

THE BEHAVIOR OF URANYL AND NEPTUNYL IONS WITH DOWEX-50 CATION-EXCHANGE RESIN. J. C. Sullivan, Donald Cohen, and J. C. Hindman (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 77, 6302-4(1955) Dec. 5.

The distribution coefficients of UO_2^{2+}, NpO_2^+, and NpO_2^{2+} between Dowex-50 resin and 1M $HClO_4$ (ionic strength = 1) have been measured as a function of time. Variations in the coefficients of neptunyl ions with time indicate that a reaction in addition to exchange is taking place. (C.W.H.)

URANIUM AND URANIUM COMPOUNDS

1765   AECD-3672
Mallinckrodt Chemical Works, St. Louis.
SOME ATTEMPTS TO PREPARE EXPLOSIVE CRYSTALS OF URANYL NITRATE HEXAHYDRATE. David T. Copenhafer. Apr. 1, 1946. Decl. with deletions Jan. 8, 1954. 11p. Contract W-7405-eng-1.

Conditions under which explosive uranyl nitrate hexahydrate (UNH) crystals might be formed when recrystallized from an aqueous or ether solution under conditions of abnormal acidity or in the presence of impurities were investigated. It is concluded that the formation of such crystals is coincidental depending on the proper balance of O_2 and oxidizable material. (C.W.H.)

1766   MIT-1105
Massachusetts Inst. of Tech., Cambridge. Metallurgical Project.
EXPLOSIONS OCCURRING DURING CHEMICAL ETCHING OR PICKLING OF URANIUM—ZIRCONIUM ALLOYS. H. P. Roth. Dec. 19, 1952. Decl. Oct. 7, 1955. 16p. Contract AT(30-1)-981.

Descriptions of five explosions involving the chemical etching of cast and extruded U—Zr alloys of high U content in HNO_3 baths are presented. It is recommended that all U—Zr alloys containing >75 wt.% U be kept out of HNO_3. (C.W.H.)

1767   RMO-2516
Rohm and Haas Co. Research Labs., Philadelphia.
ELECTROLYTIC PRECIPITATION OF URANIUM FROM FLOWING ION EXCHANGE ELUATES. Norman W. Frisch. Feb. 20, 1953. Decl. Sept. 23, 1955. 18p. Contract AT(49-1)-535.

A continuous electrolytic method has been investigated for the precipitation of U from typical eluates and composites in ion-exchange processes. This flow method employing permselective ion-exchange membranes, recovers the eluant for recycling and produces rapid settling precipitates at low energy consumption. (auth)

1768   AEC-tr-2361
A CONTRIBUTION TO THE STUDY OF THE PEROXIDES OF URANIUM AND MOLYBDENUM. Gabriel Tridot. Translated from Ann. chim. (Paris) 12, 225-54(1955). 36p.

This report is a thesis submitted to Univ. of Paris.
Infrared spectra of uranyl salts and hydrated oxides of U^{6+} are reported. The formation and chemical properties of uranyl peruranate, $(UO_2)_2UO_8$, are described. (C.W.H.)

1769

HEAT OF HYDROLYSIS OF URANIUM(IV) IN PERCHLORIC ACID SOLUTIONS. R. H. Betts (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Chem. 33, 1775-9(1955) Dec.

Using spectrophotometric techniques, the heat of hydrolysis of U^{4+} in aqueous $HClO_4$ solutions has been determined to be 10.7 ± kcal/mol and the entropy of association of U^{4+} with hydroxyl ion estimated to be +52 eu. (C.W.H.)

1770

KINETICS OF THE OXIDATION OF URANIUM (IV) BY IRON (III) IN AQUEOUS SOLUTIONS OF PERCHLORIC ACID. R. H. Betts (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Chem. 33, 1780-91(1955) Dec.

The kinetics of oxidation of U^{4+} by Fe^{3+} in aqueous solutions of perchloric acid have been investigated at four temperatures between 3.1 and 24.8°C. For the conditions $(H^+) = 0.1-1.0$ M, ionic strength = 1.02, $(Fe^{3+}) = 10^{-4}-10^{-5}$ M, and $(U^{4+}) = 10^{-4}-10^{-5}$ M, the observed rate law is $d(Fe^{2+})/dt = -2d(U^{4+})/dt = 2(U^{4+})(Fe^{3+}) [K'(H^+) + K''/(H^+)^2 + (K_1 + K_2) (H^+) + K_1K_2]$ mol/liter/sec. K_1 and K_2 are the first hydrolysis constants for Fe^{3+} and U^{4+}, respectively, and K' and K'' are pseudo rate constants. At 24.8°C., $K' = 2.98$ sec.$^{-1}$, and $K'' = 10.6$ mol liter^{-1} sec^{-1}. The corresponding temperature coefficients are $\Delta H' = 22.5$ kcal./mol and $\Delta H'' = 24.2$ kcal./mol. The kinetics of the process are consistent with a mechanism which involves, as a rate-controlling step, electron transfer between hydrolyzed ions. (auth)

1771

PREPARATION AND EXTRACTION OF URANYL PEROXIDE AS A STEP IN THE CHEMICAL PURIFICATION OF URANIFEROUS MATERIALS. E. L. Zimmer. Energia nucleare (Milan) 2, 496-9(1955) Oct. 15. (In Italian)

Some experimental results on the preparation of $UO_4\cdot2H_2O$ from solutions of uranyl salts and H_2O_2 are described. The effect of pH, temperature, concentration, presence of ammonium salts, and nature of anions in the solutions on the physical structure of the $UO_4\cdot2H_2O$ precipitate is considered, and the best conditions of the operation are indicated. The precipitation of uranium peroxide is also studied as a purification step in the treatment of raw uraniferous materials, and the usefulness and some limitations of the method are discussed. (auth)

Refer also to abstracts 1739, 1749, 1761, and 1762.

WASTE DISPOSAL

1772   KAPL-1406
Knolls Atomic Power Lab., Schenectady, N. Y.
HIGH-LEVEL CONTAMINATION CONTROL AND WASTE DISPOSAL. R. F. Stearns. Nov. 1, 1955. 19p. Contract [W-31-109-Eng-52].

The clean-up and disposal of radioactive waste in the Radioactive Materials Laboratory at the Knolls Atomic Power Laboratory is lessened considerably if the problems

of radioactive contamination are taken into consideration
during the design of irradiation test devices and laboratory
equipment. Operational experience and engineering work
have also resulted in development of many techniques and
equipment which have aided in reducing the costs of high-
level radioactive clean-up and waste disposal. (auth)

1773

CHEMICAL OPERATIONS WITH FISSION PRODUCT SOLU-
TIONS. E. Glueckauf and T. V. Healy (Atomic Energy
Research Establishment, Harwell, Berks, England).
Atomics 6, 370-9, 385(1955) Dec.

A number of chemical operations are described which
are designed to reduce the volume and acidity of waste
streams from solvent extraction plants and to remove long-
lived fission products from the solutions. In general the
operations include concentration by evaporation, de-
acidification, and separation processes for recovery of
Cs^{137} and Sr^{90}. Several methods are described for each
operation. (M.P.G.)

ENGINEERING

1774   ISC-642
Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT IN
ENGINEERING FOR APRIL, MAY, JUNE 1955. Nov. 23,
1955. 14p. Contract W-7405-eng-82.

The surface tensions of Ce and La on refractory oxides
are reported, and the circulation of Bi—U alloys (molten)
in Ta loops is described. (For preceding period see ISC-
605.) (C.W.H.)

1775   NP-5840
Mine Safety Appliances Co., Callery, Penna.
PROGRESS REPORT NO. 31 FOR OCTOBER AND
NOVEMBER 1955. W. J. Posey, ed. Dec. 12, 1955. 72p.
Contract NObs-65426.

Testing of the 3-Mw steam generators was continued.
Level indicators for liquid Na, combined valve connect
and disconnect, and AC induction pumps for liquid metals
are described. Microfissure propagation has been ob-
served as a result of quenching heated weld specimens
with liquid Na. The feasibility of using impure N_2 as a
cover gas for sodium systems was demonstrated. In-
vestigations were continued on the corrosion of Zr by
liquid Na, the removal of Hg from sodium systems by
amalgamation with Cu, and the radiation hazards arising
from leaks in liquid metal systems. (For preceding
period see NP-5779.) (C.W.H.)

1776   UR-302
Rochester, N. Y. Univ. Atomic Energy Project.
PHYSICAL PLANT FOR A RADIOACTIVE INHALATION
LABORATORY. R. H. Wilson, W. F. Neuman, A.
Rothstein, and J. K. Scott. Nov. 7, 1955. 104p. Contract
W-7405-eng-49.

The physical plant and specialized equipment used in the
Radioactive Inhalation Laboratory are described. The
laboratory was designed for studies of the distribution,
retention, excretion, toxicity, and biological effects of
inhaled radioactive materials. The proposed research
program is outlined. (C.H.)

1777

STRESSES FROM RADIAL LOADS AND EXTERNAL

MOMENTS IN CYLINDRICAL PRESSURE VESSELS. P. P.
Bijlaard (Cornell Univ., Ithaca, N. Y.). Welding J. (N. Y.)
34, 608-s-17-s(1955) Dec.

Design information on the rotations, bending moments
and membrane forces caused in cylindrical vessels by
circumferential and longitudinal moments transmitted
through various attachments are given. Data for finding the
reducing influence of internal pressure on the deflections,
rotations, bending moments and membrane forces caused
by radial loading as well as by circumferential and
longitudinal moments are also given. The cylindrical shell
is assumed to be held round at the ends. Comparison with
the well known tests by Schoessow and Kooistra shows
good agreement between computed and experimental values.
(auth)

AEROSOLS

1778   AECU-3119
Little (Arthur D.) Inc., Cambridge, Mass.
MEDIA FOR AIR CLEANING AND AIR-ASSAY PURPOSES.
Final Summary Report for period ending December 31,
1954. Oct. 3, 1955. 48p. (Includes Appendices A, B and
C.). Appendix-D: PROPERTIES OF VARIOUS FILTER-
ING MEDIA FOR ATMOSPHERIC DUST SAMPLING.
Walter J. Smith and Norman F. Surprenant. July 1, 1953.
25p. Contract AT-(30-1)-1013.

Work was completed on the high-temperature, high-
efficiency air filter. A survey was made of air-sampling
practices at 37 laboratories. Analysis of the survey re-
sults indicated that 22 different kinds of air-sampling
filter media were in use among the laboratories questioned.
A group of five media has been proposed as adequate for
meeting all requirements. Laboratory work was done on
the development of a high-efficiency, low-ash, all-purpose,
air-assay paper. Two methods of approach were tried.
In one an effort was made to produce cellulose fibrils in
sufficient quantity and quality to act as the fine-fiber
component of a filter. Only moderate success was
attained. Better promise was shown by combining
synthetic organic microfibers with cellulose fibers in a
wet-formed sheet. No plant work was undertaken on this
item. (auth)

HEAT TRANSFER AND FLUID FLOW

1779

HEAT TRANSFER IN PACKED BEDS. ANALYTICAL
SOLUTION OF TEMPERATURE PROFILES IN FIXED-
AND MOVING-BED REACTORS AND HEAT EXCHANGERS.
Andrew Pusheng Ting (Catalytic Construction Co.,
Philadelphia). Ind. Eng. Chem. 47, 2293-9(1955) Nov.

A mathematical study was made of temperature profiles
in a gas-solids bed in exchanger or reactor tubes being
heated or cooled externally. The gas streams may flow in
either fixed or moving beds of solids. Analytic equations
were developed for predicting temperature profiles in beds
under the following conditions of heating or cooling on the
shell side: con- and countercurrent shell fluid, shell fluid
at constant temperature, and constant heat flux along tube
height. Assumptions are rodlike gas flow, uniform gas
velocity, constant effective thermal conductivity, existence
of film resistance next to tube wall, and negligible thermal
conduction in directions of material flows. Equations

provide accurate solutions for uniform gas velocity; for nonuniform velocity average effective thermal conductivities should be used. (auth)

Refer also to abstract 1925.

MATERIALS TESTING

1780 WADC-TR-55-102(Pt.2)
Shell Development Co., Emeryville, Calif.
GREASE LUBRICATION OF HIGH SPEED ANTI-FRICTION BEARINGS. Report for the Period January 1 through August 31, 1955. John B. Accinelli and Charles R. Greene. Oct. 1955. 52p. Project title: AIRCRAFT LUBRICANTS. Task title: LUBRICANT MECHANICAL EVALUATION. Contract AF 33(616)-2443.

Progress is reported in the study of grease lubrication of ball bearings operating at very high DN values (1.0 × 10^6 to 2.0 × 10^6). Two high-speed rigs were designed and built for the study. These rigs, utilizing 20 mm ball bearings, required considerable development work in order to obtain satisfactory operation at the desired DN values. Before work on greases was initiated each rig was calibrated with oil-air mist lubrication by running continuously for 100 hours at 1.2 × 10^6 DN in duplicate tests with two oils, a mineral oil of SAE grade 1010 (MIL-O-6081) and a diester synthetic oil (MIL-L-6085A). The rigs are now ready for the grease studies. In the course of these calibration runs it was found that slight dynamic unbalance of the rotating components has a very deleterious effect on bearing operation, and that for successful operation, in the very high range of DN, microbalancing of the rotor is required. The very high centrifugal forces encountered in very high-speed operation seem to cause continuous stripping of the lubricant film, and this action requires that lubricant be continually applied to the bearing at a fairly high rate of flow in order to obtain prolonged operation. This factor may limit the applicability of greases as lubricants for very high-speed ball bearing application. The laboratory investigation of grease properties in a force field obtained by centrifugation was continued. It was shown that bulk greases will not adhere to metal surfaces subjected to the unimpeded stripping action of centrifugal forces comparable to those encountered in some areas of the operating high-speed bearing. Oil loss from grease structures, through the shearing and crushing action of centrifugal force, was shown to vary with grease type and composition. The results obtained permitted some qualitative conclusions on the way the grease properties studied may affect bearing operation. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

1781 NYO-7173
Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. (Progress Report.) Oct. 31, 1955. 70p. Contract AT-(30-1)-956. (MITS-29)
A study of adsorption of flotation agents on AgI was

carried out. The effect of Ag^+, Γ, and pH are given. The effect of surface potential on Ag_2S floatability was determined. The study of quartz solubility was continued using absorption methods on the blue silico-molybdate complex. Streaming potential studies on corundum at pH 10 reported. Streaming potential studies on quartz were continued. The effects of hydrocarbon chain length and pH on hemi-micelle formation are reported. Rate studies were made on the replacement of a solid-liquid interface by a solid-air interface. The effects of various reagents on the shape and velocity of bubbles are reported. The effects of impact velocity on fracture patterns and particle size were photographed. (For a previous period see NYO-7170.) (D.E.B.)

CERAMICS AND REFRACTORIES

1782
THERMODYNAMIC DATA ON OXIDES AT ELEVATED TEMPERATURES. Harlan P. Tripp and Burnham W. King (Battelle Memorial Inst., Columbus, Ohio). J. Am. Ceram. Soc. 38, 432-7(1955) Dec.
An extensive compilation of data on the free energy of formation of oxides is presented in graphic form. From these curves it is possible to obtain the free energy of most ceramic oxides in the temperature range 0 to 2400°C. (auth)

1783
FUNDAMENTAL STUDY AND EQUIPMENT FOR SINTERING AND TESTING OF CERMET BODIES. VII. FABRICATION, TESTING, AND PROPERTIES OF 34 Al_2O_3-66 Cr-Mo CERMETS. Thomas S. Shevlin and Charles A. Hauck (Ohio State Univ., Columbus, Ohio). J. Am. Ceram. Soc. 38, 450-4(1955) Dec.
The properties of a cermet solid body containing 34% Al_2O_3 and 66% 80Cr-20Mo alloy (50Al_2O_3-50 alloy by volume) are given as firing shrinkage, density, modulus of rupture, tensile strength, stress-rupture life, modulus of elasticity, oxidation resistance, thermal-shock resistance, and thermal expansion. It is shown that substitutions of the 80Cr-20Mo alloy for Cr in a similar cermet developed earlier substantially improved thermal-shock resistance. (auth)

CORROSION

Refer to abstract 1806.

GEOLOGY AND MINERALOGY

1784 RME-2015
Division of Raw Materials, AEC.
AIRBORNE RADIOMETRIC SURVEY, KERN AND SAN BERNARDINO COUNTIES, CALIFORNIA AND NYE COUNTY, NEVADA. D. C. Barrett and D. M. Magleby. Aug. 1954. 17p.
Approximately 180 square miles of mainly igneous rocks of the western Mojave Desert were covered by this airborne radiometric survey in 173 hours of flying time. Six anomalies were discovered, one of which appears to be of possible commercial value. Abnormally high radioactivity in the region appears to be associated with Cenozoic structures and, to a lesser extent, with particular

rock types mainly Jurassic granites and Tertiary volcanics. Although ore-grade material has been found at only one anomaly, some sub-surface exploration may be warranted in other favorable areas to determine the possible presence of uranium ores. (auth)

1785   RME-3110(Pt.III)
Columbia Univ., New York.
ANNUAL REPORT FOR JUNE 30, 1954 TO APRIL 1, 1955. PART III. COLLAPSE FEATURES, TEMPLE MOUNTAIN URANIUM AREA, UTAH. Paul F. Kerr, Dana R. Kelley, W. Scott Keys, and Marc W. Bodine, Jr. June 1955. 138p. Contract AT(30-1)-702.

The investigation was undertaken to collect data not only on the Temple Mountain collapse feature itself but also to study other smaller but similar features nearby. The report is a prelude to other work in preparation which concerns the mechanism of emplacement of U-bearing asphaltite, the hydrothermal alteration of the collapse areas, and non-asphaltic U mineralization. The stratig-raphy of the Temple Mountain collapse, a study of the various collapse areas, mineralization, alteration asso-ciated with the collapse features, and the organic min-erals associated with the U mineralization are reported. (For preceding period see RME-3096 (Pt.-II).) (J.E.D.)

1786
SOME THERMODYNAMIC RELATIONS AMONG THE URANIUM OXIDES AND THEIR RELATION TO THE OXIDATION STATES OF THE URANIUM ORES OF THE COLORADO PLATEAUS. Robert M. Garrels (U. S. Geological Survey, Washington, D. C.). Am. Mineralogist 40, 1004-21(1955) Nov.-Dec.

Fields of stability of uranium(VI) and uranium(IV) hydroxides and oxides in water solution at 25°C and one atmosphere pressure have been calculated as functions of Eh and pH. Equilibrium values of the activity of UO_2^{++} ion and of U^{4+} ion also have been calculated and are shown as contours on the stability fields. Thermodynamic relations among the uranium(VI) hydroxides and hydrated oxides indicate that the free energy differences among the various species are small. The data are interpreted to mean that a variety of such uranium(VI) compounds may form and even coexist. Similar studies of the uranium(IV) hydroxide in-dicate that it is unstable relative to the oxide and may well be expected to change to the oxide at a finite rate. Uranium(V) compounds probably have a transitory existence because of the instability of the UO_2^+ ion; uranium(III) oxides and hydroxides would not be expected to occur naturally because the uranium(III) ion would decompose water. A comparison of the behavior of the vanadium(III) and (IV) hydroxides with uranium(IV) oxide and uranium(VI) hydroxides indicates that vanadium(III) hydroxide should oxidize to the vanadium(IV) hydroxide at a lower potential than that required for the change from uranium(IV) to uranium(VI). A rather highly speculative diagram showing probable fields of stability of many of the major minerals of the Colorado Plateaus is presented, and the suggestion is made that a consistent picture results if it is assumed that the ores, as viewed today, represent the superimposi-tion of a weathering environment on a mineral assemblage that was formed in a primary reducing environment. It is emphasized that such an interpretation is consistent but not necessarily unique. (auth)

1787
PRESENT STATE OF URANIUM AND THORIUM SURVEYS

IN ITALY. F. Ippolito. Energia nucleare (Milan) 2, 479-89(1955) Oct. 15. (In Italian)

After a short survey of the geological configuration of Italy with respect to uranium and thorium minerals, the research and prospecting work done by Comitato Nazionale per le Ricerche Nucleari and some private enterprises is described. These investigations have been made mostly on the eastern Alps with encouraging results. The method used for prospecting is also described. (auth)

1788
DISTRIBUTION OF RADIOACTIVE BEACH SANDS. B. S. R. Rao and P. Nukiah Chetty (Andhra Univ., Waltair, India). J. Sci. Ind. Research (India) 14A, 493-4(1955) Oct.

A study is reported on the occurrence of radioactive minerals in the beach sands along Visakhapatnam coast. Monazite was found to be present in the sands associated with other heavy minerals such as ilmenite and magnetite. A direct method of locating monazite sands was used by taking advantage of their radioactive properties. (J.E.D.)

1789
URANIUM DEPOSITS IN FALL RIVER COUNTY, SOUTH DAKOTA. Henry Bell and W. E. Bales. U. S. Geol. Survey Bull. 1009-G, 1955. 23p. plus 5 illus.

In 1951 uranium deposits containing carnotite were dis-covered in the southern Black Hills near Edgemont, Fall River Co., S. Dak. Many carnotite deposits have since been found in sandstones in the Inyan Kara group of Early Cretaceous age, and uranium-bearing material has been discovered in the Minnelusa sandstone of Pennsylvanian age and the Deadwood formation of Cambrian age in the southern Black Hills. Ore has been produced only from the Inyan Kara group, mostly within an area of about 30 square miles along the southwest flank of the Black Hills uplift between Dewey and Hot Springs, in Custer and Fall River Counties. In addition, occurrences of uranium in other parts of the Black Hills and the surrounding area are known or reported in sedimentary, igneous, and metamorphic rocks of pre-Cambrian to Tertiary age. The lowermost and uppermost formations of the Inyan Kara group—the Lakota and Fall River sandstones—contain the productive uranium deposits. These terrestrial formations are com-posed predominantly of massive sandstone lenses with thin units of thinly bedded sandstone and mudstone, but locally they contain abundant mudstone and thinly bedded sandstone. The massive sandstone lenses commonly overlap and truncate underlying lenses. Iron stain, carbonaceous mate-rial, thin seams of gypsum, ripple marks, concretions, and fossil roots are common in the mudstone and thinly bedded portions of these formations. Some high-angle normal faults of small displacement are found in the area contain-ing the largest number of uranium occurrences in the Inyan Kara group. Although no ore deposits seen were cut by faults, high-angle fractures parallel to and at right angles to the faults contain carnotite for short distances. The productive uranium deposits are most common where the Lakota and Fall River sandstones locally contain a large proportion of mudstone and thinly bedded sandstone. Other deposits are in the massive sandstone lenses of the Lakota sandstone and in the thin units between the lenses. Al-though carnotite is the most conspicuous and important mineral in most deposits, corvusite is an important con-stituent of some deposits. Other uranium minerals in the deposits are tyuyamunite, rauvite, and autunite. Ore pro-duced in 1952 from the Fall River and Lakota sandstones

contained about 0.2 percent of U_3O_8 and 0.6 percent of V_2O_5. In general, deposits in the Fall River and Lakota sandstones contain about the same percentage of U_3O_8, but the deposits in the Fall River sandstone appear to have a higher percentage of vanadium. The grade of individual deposits, however, is highly variable. Most deposits are small, but a few have yielded as much as a thousand tons of ore. (auth)

1790
CARNOTITE-BEARING SANDSTONE IN CEDAR CANYON, SLIM BUTTES, HARDING COUNTY, SOUTH DAKOTA. James R. Gill and George W. Moore. U. S. Geol. Survey Bull. 1009-I, 1955. 16p. plus 2 illus. $0.35 (GPO)
  Carnotite-bearing sandstone and claystone have been found in the Chadron formation of the White River group of Oligocene age in the southern part of the Slim Buttes area, Harding Co., S. Dak. The carnotite is an efflorescent yellow coating on lenticular silicified sandstone. Locally, the mineralized sandstone contains 0.23% uranium. The uranium and vanadium ions are believed to have been derived from the overlying mildly radioactive tuffaceous rocks of the Arikaree formation of Miocene age. Analyses of water from 26 springs issuing from the Chadron and Arikaree formations along the margins of Slim Buttes show uranium contents of as much as 200 parts per billion. Meteoric water percolating through tuffaceous rocks is through to have brought uranium and other ions into environments in the Chadron formation that were physically and chemically favorable for the deposition of carnotite. (auth)

1791
PHOTOGEOLOGIC MAP OF THE TIDWELL-15 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-109. V. H. Sable. Washington, U. S. Geological Survey, 1955. $0.50.

1792
PHOTOGEOLOGIC MAP OF THE WOODSIDE-4 QUADRANGLE, EMERY AND CARBON COUNTIES, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-110. V. H. Sable. Washington, U. S. Geological Survey, 1955. $0.50.

1793
PHOTOGEOLOGIC MAP OF THE WOODSIDE-12 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-111. P. P. Orkild. Washington, U. S. Geological Survey, 1955. $0.50.

1794
PHOTOGEOLOGIC MAP OF THE TIDWELL-4 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-112. P. P. Orkild. Washington, U. S. Geological Survey, 1955. $0.50.

1795
PHOTOGEOLOGIC MAP OF THE TIDWELL-5 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-113. P. P. Orkild. Washington, U. S. Geological Survey, 1955. $0.50.

1796
PHOTOGEOLOGIC MAP OF THE TIDWELL-9 QUADRANGLE, EMERY AND GRAND COUNTIES, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-114. C. E. Bates and V. H. Sable. Washington, U. S. Geological Survey, 1955. $0.50.

1797
PHOTOGEOLOGIC MAP OF THE TIDWELL-16 QUADRANGLE, EMERY AND GRAND COUNTIES, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-115. P. P. Orkild. Washington, U. S. Geological Survey, 1955. $0.50.

1798
PHOTOGEOLOGIC MAP OF THE MOAB-10 QUADRANGLE, GRAND COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-116. C. E. Bates. Washington, U. S. Geological Survey, 1955. $0.50.

1799
PHOTOGEOLOGIC MAP OF THE MOAB-12 QUADRANGLE, GRAND COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-117. V. H. Sable. Washington, U. S. Geological Survey, 1955. $0.50.

1800
PHOTOGEOLOGIC MAP OF THE MOAB-13 QUADRANGLE, GRAND AND EMERY COUNTIES, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-118. W. E. Bergquist. Washington, U. S. Geological Survey, 1955. $0.50.

1801
PHOTOGEOLOGIC MAP OF THE MOAB-14 QUADRANGLE, GRAND COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-119. V. H. Sable. Washington, U. S. Geological Survey, 1955. $0.50.

1802
DISTRIBUTION OF RADIOACTIVITY IN PELAGIC CLAYS. Gustaf Arrhenius and Edward D. Goldberg (Scripps Institution of Oceanography, La Jolla, Calif. and California Inst. of Tech, Pasadena). Tellus 7, No. 2, 226-31(1955). (In English)
  The localization of radioelements in different mineral phases of pelagic clay sediments was studied. The results indicate that the ionium supported radium is redistributed by diffusion through the interstitial solution and that the authigenic zeolite phillipsite plays an important role as a scavenger of radioelements within the deposit. The mechanism of transfer of radioelements from the ocean to pelagic deposits is discussed, and points of uncertainty in the interpretation of the distribution of gross beta activity are indicated. (auth)

METALS AND METALLURGY

1803   AECD-3665
Sylvania Electric Products Inc. Atomic Energy Div., Bayside, N. Y.
THE POWDER METALLURGY OF URANIUM. H. H. Hausner and J. L. Zambrow. May 27, 1955. Decl. July 7, 1955. 18p. Contract [AT-30-1-GEN-366]. (DCF-5704).
  The powder metallurgy of uranium as UH_3 is discussed. Microstructures of U compacts are shown, and data on compacting and sintering temperatures are graphed. (B.J.H.)

1804   AECD-3680
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
TENSILE PROPERTIES OF ZIRCONIUM AND ZIRCONIUM ALLOYS. PART I. ZIRCONIUM AND ALLOYS WITH OXYGEN, COLUMBIUM, TIN, COPPER, VANADIUM,

TUNGSTEN, AND TANTALUM. C. R. Simcoe and W. L.
Mudge, Jr. Nov. 20, 1951. Decl. with deletions Oct. 5,
1955. 70p. Contract AT-11-1-GEN-14.

The tensile properties of rolled and annealed Zr and Zr
alloy sheet were determined as a function of temperature in
the range from room temperature to 750°F. The tensile
and yield strengths determined for nominally pure Zr are
lower than those heretofore reported. The alloying
elements investigated include: O, Nb, Sn, Cu, V, W, Ta,
and Hf. Although no unique improvement in tensile proper-
ties were observed for any of the elements, Nb and Sn
additions result in retention of improved tensile properties
to a temperature of 600°F. Where both transverse and
longitudinal specimens of an alloy were tested the yield
and tensile strengths are higher and lower respectively,
for the transverse direction. (auth)

1805   AECU-3120

Case Inst. of Tech., Cleveland.
SCALING OF ZIRCONIUM AT ELEVATED TEMPERA-
TURES. Quarterly Status Report No. 10. Sept. 2, 1955
to Dec. 2, 1955. C. A. Barrett, E. B. Evans, and W. M.
Baldwin, Jr. Dec. 8, 1955. 4p. Contract AT(11-1)-258.

1806   ANL-5354

Argonne National Lab., Lemont, Ill., and Babcock and
    Wilcox Co. Research Center, Alliance, Ohio.
CORROSION OF METALS IN HIGH TEMPERATURE
WATER AT 500°F AND 600°F. S. C. Datsko and Calvin
R. Breden. Oct. 6, 1954. 203p. Contract W-31-109-eng-
38. Subcontract 31-109-38-188. (BAW-5314)

Results of corrosion tests on a variety of metallic alloys
obtained during the period from February, 1949 through
July, 1953 are summarized. The corrosion behavior of a
series of structural materials, which included zirconium
and zirconium alloys, was investigated. Several water
treatments not generally used were employed in an attempt
to minimize corrosion, and the effects of these treatments
are discussed. Several materials, such as the 300 series
stainless steels and certain types of zirconium, have been
found to be satisfactory at both 500 and 600°F in all en-
vironments in which they were tested. Other materials
were found to be satisfactory under specific conditions.
At 500°F the addition of over 50 cc of hydrogen per liter
of water permits the widest selection of materials. (auth)

1807   BM-RI-5169

Bureau of Mines.
PRODUCTION OF HAFNIUM. H. P. Holmes, M. M. Barr,
and H. L. Gilbert. July 1954. 36p.

Tonnage quantities of hafnium metal have been prepared
in Kroll-process equipment designed for producing Zr.
Some slight process modifications have been necessary,
but overall operation is the same as for Zr. Hafnium oxide
is chlorinated in the presence of C and the resultant $HfCl_4$
reduced by Mg metal. Byproduct $MgCl_2$ is removed in a
high-vacuum distillation step and the Hf sponge metal
crushed for further use. Arc-melted metal can be forged
and rolled to sheet, but the best material produced to date
would not be considered cold ductile. (auth)

1808   BM-RI-5170

Bureau of Mines.
ELECTRIC SMELTING OF ILMENITE CONCENTRATES
FROM VALLEY COUNTY, IDAHO. L. H. Banning, W. F.
Hergert, and D. E. Halter. Feb. 1955. 21p.

Recent dry-top electric smelting tests indicate that a
high-Ti slag and a good grade of pig Fe can be produced
from alluvial Idaho ilmenite. A total of 120 tons of con-
centrates were smelted during this investigation, to yield
an average of 0.5 ton of slag and 0.3 ton of pig Fe per ton
of ilmenite. Power consumption averaged 1,400 kv-hr per
ton of ilmenite, at a feed rate of 400 to 500 lb per hr, when
operating at an electrical energy input of 290 to 370 kw.
The optimum operating voltage appeared to be 110 volts
phase-to-phase. Graphite electrode consumption averaged
15.6 lb per ton of ilmenite smelted. Magnesite furnace
refractory withstood the corrosive action of the hot metal
and slag better than carbon refractory. During these tests,
types and amounts of reductant required to reduce the Fe
from the ilmenite and produce a slag having the highest
possible Ti content were studied. Fluidity of slag deter-
mined the upper limit of reduction, as Ti slags containing
less than 10% Fe-plus-Mn were very viscous at usual
operating temperatures. Hogged fuel and coke were the
reductants used. Slags containing between 67 and 86%
TiO_2 were produced. The TiO_2 content of the majority of
the slags varied between 80 and 84% and averaged about
4.5% Mn and 0.5% Cb_2O_5. The Fe content varied inversely
to the TiO_2 content, usually between 7 and 9%. The amount
of Ti reduced to metal was insignificant. During a 40-hr
period, high-grade Mn ore was added to the furnace charge
to determine whether the Mn would replace the Fe in the
slag. The most logical use of the slag product is for the
production of $TiCl_4$, which is used by the Ti metal industry.
Iron chloride is a waste product of such an operation and
manganese chloride might be a valuable byproduct. The
results of the test were encouraging; during one 8-hr shift
the average Fe content of the slag was only 2.1%. The
presence of Nb_2O_5 in the slag, approximately 0.53%, is also
of much interest, as there is a possibility of recovering
columbium as a valuable coproduct in a slag-chlorination
operation. (auth)

1809   EES-4C(8)17X1603

Naval Engineering Experiment Station. Metallurgical
    Lab., Annapolis.
SUMMARY REPORT ON STEAM PIPING FOR HIGH-
TEMPERATURE SERVICE — INVESTIGATION OF CHAR-
ACTERISTICS AFFECTING THE USE OF AUSTENITIC
AND FERRITIC STEELS. William C. Stewart and W. L.
Williams. [1951?]. 91p.

Test results are summarized for thermal shock speci-
mens and mock-ups of ferritic and austenitic steels.
Complete test data are reported for a laboratory test
program which was undertaken to supplement the full-
scale tests. Thermal shock tests of six-inch pipe and
valve assemblies are described. Specimens were of two
weights, schedules 80 and 160. The shock treatment was
designed to simulate the quenching action that might result
from the carry over of boiler water into a pipe line
carrying steam at 1050°F, temperature. The steam pres-
sure for the 80-schedule specimens was 900 psi, and for
the 160-schedule specimens, 2000 psi. Each assembly was
subjected to 100 shocks. The effect of mechanical loading
on full-scale members was investigated by testing mock-
ups which were designed to simulate expansion bends. A
mock-up corresponding to each of the four thermal shock
specimens was tested. Each mock-up was subjected to
4000 deflections so adjusted as to induce a range of
equivalent stress predicated on changing from a safety
factor of 5 to 4. High-temperature test data were obtained

for laboratory specimens. The specimens were taken from pipe and casting assemblies which were fabricated and heat treated in the same manner as the full-scale test members. Results include tensile properties to 1100°F, and stress-rupture, creep, and fatigue properties at 1000 and 1100°F temperatures. Tests were also made of specimens taken from thermal shock specimens and mock-ups. (auth)

1810 HW-39190
Hanford Atomic Products Operation, Richland, Wash.
REACTION KINETICS OF ZIRCONIUM AND ZIRCALOY-2 IN DRY AIR AT ELEVATED TEMPERATURES. L. F. Kendall. Sept. 26, 1955. 25p. Contract W-31-109-Eng-52.

Corrosion rates of sponge Zr and Zircaloy-2 in dry air were measured at 500, 600 and 700°C. The reaction proceeds in two stages: initially the rate decreases with exposure time, approximating a cubic relationship; after sufficient exposure, the rate becomes a linear function of time. The rate constants calculated from the data and expressed by the Arrhenius equation are given. Extrapolation of these data to lower temperatures indicates a service life of several years for these metals below 400°C (D.E.B.)

1811 NP-5837
Rensselaer Polytechnic Inst., Troy, N. Y.
NOTCH SENSITIVITY OF THE WELD HEAT-AFFECTED ZONES OF A 6% Al—4% V TITANIUM ALLOY. Final Report. Ernest F. Nippes and John M. Gerken. Oct. 1955. 25p. 00 Project TB4-31. Contract DAI-30-115-ORD-(P)-642.

A 6% Al—4% V titanium alloy was studied to determine the effects of the various weld thermal cycles on the notch toughness of the heat-affected zone in this material. The individual thermal-cycles for an energy input of 50,000 joules per inch using $\frac{1}{2}$-inch titanium alloy plate with no preheat were reproduced in Charpy V-notch impact specimens using a time-temperature controller. In addition, a study of the continuous cooling transformation of this alloy was made over a large range of cooling rates. (auth)

1812 NP-5838
Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
PERIODIC STATUS REPORT NO. 13 [FOR] AUGUST 1955—OCTOBER 1955. I. MODE OF DEFORMATION AND FRACTURE NEAR THE MELTING POINT. II. THE IRON—CHROMIUM—NICKEL TERNARY SYSTEM. III. SUB-STRUCTURE STUDIES. N. J. Grant, F. B. Cuff, P. E. Price, and M. B. Happ. 7p. [Project] NR-039-007. Contract N5-ori-07881.

Diffusion studies were made on the Cr—Ni system, and the resulting data are summarized. The status of other projects is discussed very briefly. (B.J.H.)

1813 NP-5841
California Inst. of Tech., Pasadena.
THE MECHANISM OF YIELDING. Final Report. D. S. Clark and D. S. Wood. Sept. 1955. 25p. Project NR-031-285. Contract N6onr-24418.

Summaries are presented of investigations on discontinuous and delayed yielding in low-carbon steel, Mo, and Al. (C.W.H.)

1814 NYO-6599
Carnegie Inst. of Tech., Pittsburgh.
LATTICE IMPERFECTIONS AND GRAIN BOUNDARIES. Progress Report for July 1954—July 1955. Dept. of Metallurgical Engineering. R. Smoluchowski, C. Coleman, W. H. Robinson, E. W. Toor, and L. Vassamillet. Sept. 8, 1955. 5p. Contract AT(30-1)-Gen-359.

Grain-boundary diffusion of Al in columnar Cu has been studied. Bicrystals having pure twist boundaries have been obtained and diffusion runs for various angles are in progress. Results of small-angle x-ray scattering studies indicate that surface structure may produce strong scattering which interferes with the interpretation of scattering by volume defects. (D.E.B.)

1815 SEP-113
Sylvania Electric Products Inc. Atomic Energy Div., Bayside, N. Y.
RECRYSTALLIZATION AND GRAIN GROWTH CHARACTERISTICS IN ZIRCONIUM AND ZIRCONIUM—TIN ALLOYS. F. D. Rosi and F. C. Perkins. June 29, 1953. Decl. Apr. 12, 1954. 37p. Contract AT-30-1-GEN-366.

A metallographic study was made of the deformation, recrystallization, and grain growth characteristics in sintered zirconium and zirconium—1, 3, and 5% tin alloys. Recrystallization occurred preferentially at grain boundaries and in deformation twins, and the recrystallization temperature range was determined for the material cold-rolled 30 and 50%. A rate study was made of the material cold-rolled 50% in order to evaluate the temperature dependence of both the recrystallization and grain growth processes. Grain growth after recrystallization was essentially continuous, and the isothermal grain growth data obeyed the generalized parabola: $D = Kt^n$. (auth)

1816 SEP-123
Sylvania Electric Products Inc. Atomic Energy Div., Bayside, N. Y.
AN INVESTIGATION OF THE HYDROGEN GLOW DISCHARGE AS A MEANS OF REDUCING METAL HALIDES. C. I. Whitman and R. B. Holden. Sept. 29, 1953. Decl. Oct. 11, 1955. 29p. Contract AT-30-1-GEN-366.

The reduction of the halides of Be, Th, U, and Zr by volatilizing the halide into a glow discharge in H_2 has been studied. The method is not suitable for the preparation of U or Be. The two experiments made with Th were not promising. The preparation of Zr, however, shows considerable promise. Single-pass yields of 10 to 20% of metal or metal hydride were frequently obtained. In addition, portions of the product were characteristically 70 to 90% hydride. (auth)

1817 TID-5212
Technical Information Service, AEC.
THE CHEMISTRY AND METALLURGY OF MISCELLANEOUS MATERIALS. Lawrence L. Quill, ed. Sept. 1955. 172p.

The following papers on the chemistry and metallurgy of miscellaneous materials are presented: the rate of sublimation of solids; the preparation of cerium by electrolysis of molten salts; preparation of cerium by chemical reduction in open crucibles in an inert atmosphere; the production of cerium in the massive metallic state; the casting of cerium and some properties of the cast metal; recovery of iodine from cerium slag; the production of beryllium by the metallothermic reduction of beryllium

fluoride; the extrusion of beryllium; production of beryllium metal ingots for extrusion; fused beryllium oxide and refractory shapes; geochemistry of beryllium; geochemistry of germanium; the geochemistry of indium; the geochemistry of niobium and tantalum; remote control for continuous liquid extractors; solubility of xenon and nitric oxide in various solvents; infrared spectrum of benzene; minimum hydrogen peroxide concentration required for precipitate formation from 50 per cent uranyl salt solutions; the system nitric acid-water—methyl isobutyl ketone; the preparation of tungsten hexafluoride; the preparation of molybdenum hexafluoride; production of high boron steel; the crystal structure of trichlorides, tribromides, and trihydroxides of uranium and of rare earth elements; and identification and crystal structure of barium hydrogen phosphate. (J.E.D.)

1818   TML-8
Battelle Memorial Inst. Titanium Metallurgical Lab.,
  Columbus, Ohio.
PRINCIPLES AND PRACTICAL ASPECTS OF TITANIUM
HEAT TREATMENT. P. D. Frost. June 20, 1955. 20p.
Contract AF 18(600)-1375.
    A part of the physical metallurgy of Ti alloys has been reduced to basic instructions for fabricators. Specifically treated are alpha and beta phase stabilizers and their suitability for heat treatment. (D.E.B.)

1819   TML-22
Little (Arthur D.) Inc., Cambridge, Mass.
SELECTIVE STANDARDIZATION AND STATUS OF
SPECIFICATIONS FOR TITANIUM MILL PRODUCTS.
Nov. 22, 1955. 19p. For Titanium Metallurgical Lab.,
Battelle Memorial Inst. Contract AF 18(600)-1375,
Subcontract No. 1.
    Producers of wrought Ti have been hampered in the marketing of their products by the wide variety of specifications being used by the consuming manufacturers. To facilitate standardization of specifications, a survey of requirements was made, and general specifications are suggested. (D.E.B.)

1820   TML-24
Battelle Memorial Inst. Titanium Metallurgical Lab.,
  Columbus, Ohio.
THE APPLICATION OF A NEW STRUCTURAL INDEX TO
COMPARE TITANIUM ALLOYS WITH OTHER MATERIALS
IN AIRFRAME STRUCTURES. L. R. Jackson and S. A.
Gordon. Dec. 1, 1955. 33p. Contract AF 18(600)-1375.
    Established formulas for evaluating structural materials for airframes is often unreliable. A new method of predicting the failing load of a section in compression has been suggested. This new structural index is compared with compression test results on Al sections and Ti alloys angles and channels at room and elevated temperatures. Excellent agreement is obtained in all cases. (D.E.B.)

1821   WAL-310/90-85
Case Inst. of Tech., Cleveland.
HANDBOOK ON THE PROPERTIES OF COLD WORKED
STEELS. Final Report. L. J. Ebert. June 1955. 93p.
Project title: [INVESTIGATIONS OF THE SIGNIFICANT
PROPERTIES AND CHARACTERISTICS OF COLD
WORKED STEELS]. Contract DA-33-019-ORD-1464.
    A tabular presentation of the important properties of cold worked steels is made and a discussion of a number of generalized effects and suggestions of factors which

might be considered in the design selection and successful application of cold work steels are presented. (auth)

1822   WAPD-131
Westinghouse Electric Corp. Atomic Power Div.,
  Pittsburgh.
THE DEVELOPMENT AND PRODUCTION OF HEAVY-
WALLED BACK-EXTRUDED ZIRCALOY-2 CUPS. J. G.
Goodwin and R. W. Tombaugh. Oct. 29, 1955. 46p.
Contract AT-11-1-GEN-14.
    Bar stock preparation is first discussed, after which development work at Scaife Company, Aluminum Company of America, Wyman-Gordon Company, and Bettis is presented. Production of the cups at Bettis is discussed, with detailed procedure for extrusion. (auth)

1823   WAPD-SFR-FF-192
Westinghouse Electric Corp. Atomic Power Div.,
  Pittsburgh.
TENSILE AND IMPACT TEST RESULTS ON IRRADIATED
BORON-STAINLESS STEEL. J. J. Lombardo. June 28,
1955. 5p.

1824   AEC-tr-2347
THE PROCESSES OF FATIGUE FAILURE IN ALLOYS WITH
"ANNEALING TWINS." (Ustalostnyie Protzessy
Razrusheniya V Splavakh S "Dvoinikami Otzhiga.") N. F.
Lashko and E. M. Radetzkaya. Translated from Zhur. Tekh.
Fiz. 24, 417-23(1954). 8p.

1825
GETTERING OF GAS BY TITANIUM. Virgil L. Stout and
Martin D. Gibbons (General Electric Research Lab.,
Schenectady, N. Y.). J. Appl. Phys. 26, 1388-92(1955) Dec.
    Titanium metal has been studied as a getter for oxygen, nitrogen, carbon dioxide, air, water vapor, hydrogen, and methane. Titanium above 700°C will getter oxygen, nitrogen, and carbon dioxide. Hydrogen is absorbed by titanium in the temperature range of 25 to 400°C. Water vapor and methane are readily sorbed when the metal is operated at both elevated and reduced temperatures. Large quantities of gases can be sorbed; sorption of ten to ninety atomic percent is possible. When saturated with gas, the metal becomes brittle and is easily fractured. Hydrogen gas is the only gas which can be released by heating after it has been sorbed by titanium. (auth)

1826
INVESTIGATION OF THE FATIGUE OF METALS BY X-
RAY SCATTERING. A. Franks and J. Holden (National
Physical Lab., Teddington, England). Nature 176, 1022-3
(1955) Nov. 26.
    Results of low-angle x-ray scattering studies suggest that metal fatigue information may be gained by this method. Further experiments are in progress. (D.E.B.)

1827
PREPARATION OF METAL POWDERS FOR NUCLEAR
REACTORS. P. Chiotti and H. A. Wilhelm (Iowa State Coll.,
Ames). Metal Progr. 68, No. 6, 77-80(1955) Dec.
    A discussion is given of the preparation of U and Th powders by forming the hydride and decomposing it by heating under reduced pressure. (B.J.H.)

1828
FABRICATION OF ZIRCONIUM BY POWDER METAL-
LURGY TECHNIQUES. Harold H. Hirsch (General Electric
Research Lab., Schenectady, N. Y.). Metal Progr. 68, No.
6, 81-5(1955) Dec.

The fabrication of Zr by pressing zirconium hydride powder and vacuum sintering at moderate temperatures is discussed. The rolling and extrusion of canned billets are also discussed. The properties of Zr powders and compacts are discussed. (B.J.H.)

1829

THE MECHANISM OF SINTERING OF NONVOLATILE METALS AND OXIDES. Leslie L. Seigle and A. L. Pranatis (Sylvania Electric Products Inc., Bayside, N. Y.). Metal Progr. 68, No. 6, 86-90(1955) Dec.

Various sintering mechanisms are discussed, and illustrations are given. It is concluded that volume diffusion is the rate-controlling process in all but the initial stages of sintering of normally sized particles of nonvolatile metals and oxides. The influence of grain boundaries on sintering rates is also discussed. (B.J.H.)

1830

VACUUM MELTED METAL—AN INTERIM REPORT. Frank T. Chesnut (Ajax Electrothermic Corp., Trenton, N. J.). Metal Progr. 68, No. 6, 118-23(1955) Dec.

The status of vacuum melting of metals is reviewed. Included are discussions of current problems, uses in the manufacture of jet engine blades and magnetic alloys, and economics. (B.J.H.)

1831

MECHANICAL PROPERTIES OF MODIFIED TYPE 347 WELD METALS. R. David Thomas, Jr. and Lorin K. Poole, comps. (Arcos Corp., Philadelphia). Welding J. (N. Y.) 34, 583-s-95-s(1955) Dec.

Acceptable crack resistance and commercial usability were demonstrated by a standard (partially ferritic) Type 347 weld deposit, a Type 347CbTa weld deposit, a Type 308ELC weld deposit and two fully austenitic Type 347 compositions, one of which was modified by raising the carbon content to 0.12% and the other by raising the manganese to 5%. A standard composition modified to be fully austenitic was found to be unacceptable. Tensile and Charpy keyhole impact specimens were tested in the as-welded condition, after 8- and 100-hr heat treatments at 1100, 1300, 1550 and 1700°F and after 2-, 8-, and 24-hr heat treatments at 1950°F. The 0.505-in. diameter tensile properties of all compositions showed highest strength and lowest elongation when heat treated at 1100 and 1300°F. The optimum ductility was observed after heat treatments of 1700°F and higher. Optimum notched bar impact toughness at both room temperature and −320°F was observed after heat treatments at 1700°F and higher. The partially ferritic weld deposits showed greater tendency to embrittle after heat treatments at 1100 and 1300°F than did the fully austenitic Type 347 compositions. High notched bar impact values were obtained from the Type 308ELC weld deposit after all heat-treating conditions. (auth)

1832

MEASUREMENT OF SHUNTING CURRENTS IN SERIES SPOT WELDING 0.036-IN. STEEL. E. F. Nippes, W. F. Savage, and S. M. Robelotto (Rensselaer Polytechnic Inst., Troy, N. Y.). Welding J. (N. Y.) 34, 618-s-24-s(1955) Dec.

The purpose of this investigation was to find the distribution and magnitude of the shunting or short-circuit currents in the series spot welding of 0.036-in. low-carbon auto body steel. The effect on the short-circuit current of such variables as spot spacing, electrode geometry, backing bar geometry, stock preparation and electrode force was investigated. The apparatus used to measure the shunting currents is fully explained. (auth)

1833

VACUUM METALLURGY (Papers Presented at the Vacuum Metallurgy Symposium of the Electrothermics and Metallurgy Division of the Electrochemical Society, October 6 and 7, 1954 at Boston, Mass.). Baltimore, The Electrochemical Society, Inc., 1955. 213p.

Included are papers on arc melting in high vacuum, vacuum melting of high-alloy materials, impact properties of vacuum melted Fe−Cr alloys, vacuum induction-melted Zr and Zr alloys, vacuum and pressure melting of iron-base alloys, the design and operation of an induction and a resistance furnace for high vacuum-high temperature applications, a method for the evaluation of high-vacuum furnaces and heat-treating atmospheres, the theory and performance characteristics of a Kinney mechanical booster pump, rotary gas ballast pumps, the economics of vacuum melting, deoxidation of vacuum-melted M252, H deoxidation of vacuum-melted high-temperature alloys, the application of vacuum technology to metallurgical processes, vacuum heat-treating techniques, solid-state purification of Mo by induction heating, vacuum degassing of Ti, determination of the vapor pressure of metals and alloys, and experiments on vacuum distillation of nonferrous metals and alloys. (B.J.H.)

1834

KINETICS OF ORDER-DISORDER TRANSFORMATIONS. G. J. Dienes (Brookhaven National Lab., Upton, N. Y.). Acta Met. 3, 549-57(1955) Nov.

A simple theory of the kinetics of order-disorder transformations, based on chemical rate theory, is presented. The theory is constructed entirely in terms of the long range order parameter and reduces to the Bragg and Williams theory at equilibrium. There are several unusual features in the theoretical rate curves. The origin of these characteristics is the order parameter dependence of the energy of ordering. It is shown that ordering must start by fluctuations which are expected to be particularly large for an AB_3 alloy. Thus, the shapes of the ordering curves remind one of nucleation and growth processes, although they are derived entirely from simple rate theory. The theory is shown to be in agreement with the experimentally known qualitative behavior of order-disorder systems. For example, the theory predicts a maximum ordering rate slightly below the critical temperature in agreement with experiment. An improvement of the Bragg and Williams equilibrium theory is also suggested, based on a nonlinear dependence of the ordering energy on the long-range order parameter, which leads to excellent agreement with experiment. The kinetic theory is modified accordingly, resulting in quantitative but not qualitative changes in the predicted rate curves. There are insufficient experimental rate data for a critical quantitative evaluation of the kinetic theory. (auth)

TRACER APPLICATIONS

1835

RADIOACTIVE ISOTOPES IN TECHNOLOGY. P. E.

D'yachenko. Vestnik Akad. Nauk S.S.S.R. 25, 37–47(1955) Oct. (In Russian)

A review. (R.V.J.)

PHYSICS

1836 AECU-3125
RAND Corp., Santa Monica, Calif.
PHOTOELECTRIC K AND L SHELL ABSORPTION COEFFICIENTS FOR HIGHLY IONIZED ATOMS. S. A. Moszkowski and R. E. Meyerott. Nov. 1, 1955. 20p. For Los Alamos Scientific Lab. Contract [W-7405-eng-36], Subcontract SC-9. (RM-1578-AEC)

This report describes a simple way to calculate numerical values of K and L shell photoelectric absorption coefficients (averaged over subshells) for highly ionized atoms. (auth)

1837 ANL-5412
Argonne National Lab., Lemont, Ill.
PHYSICS DIVISION QUARTERLY REPORT [FOR] MAY, JUNE, AND JULY 1954. Sept. 1955. 73p. Contract W-31-109-eng-38.

Evaluation of liquid scintillation detectors for neutrons was continued. The formula for one mixed organic scintillator is given. The characteristics of a detector for neutron capture, fission, and scattering are described. Van de Graaff operations were continued and statements on machine developments and malfunctions are given. Work on the decay of Ti^{51} has disclosed an additional gamma transition of 0.61 Mev. A new decay scheme is proposed. Investigations of the gyromagnetic ratio of Pb^{204} isomeric states revealed a third gamma transition of 900 kev. A gyromagnetic ratio of $+1.20 \pm 0.12$ for the 480-kev excited state of Ta^{181} was established. Hyperfine structure separation and nuclear moments for Cs^{134} are reported. Detector arrangements for neutron scattering distribution studies are described. Planned attempts at proton beam energy stabilization which are expected to improve the technique and stability of total neutron cross section measurements are described. Possible methods of controlling fold-over in recoil neutron spectrometers are discussed. A successful fluorescence photometer method of U analysis is reported. Investigations of plastic preparations for neutron and gamma scintillators were continued. Steady current investigations for several dielectrics were made and the activation energies reported. (For preceding report see ANL-5317.) (D.E.B.)

1838 ARL/R3/E600
Gt. Brit. Admiralty Research Lab., Teddington, Middlesex, England.
ATMOSPHERIC ATTENUATION OF INFRA-RED AND VISIBLE RADIATION. Dec. 1948. 95p. (ACSIL/ADM/50/249)

A survey has been made of the information available on the transmission of the atmosphere to infra-red and visible radiation. The attenuation is caused by scattering and by absorption, and both effects are wavelength dependent. Atmospheric absorption is more important in the infra-red, and a short discussion is given of the laws of absorption and the effects of pressure and temperature. The theory of scattering by small particles is mentioned;

in the visible the attenuation is caused almost completely by scattering, and the visual range can be evaluated in terms of the number and size of the particles in the atmosphere. There are two main types of particles, the combustion nuclei and the sea-salt nuclei. A bibliography is attached which includes as far as possible all existing references to the literature on the subject of atmospheric transmission. (auth)

1839 MLM-1060
Mound Lab., Miamisburg, Ohio.
THE MOUND LABORATORY THERMAL BATTERY: SOME PRACTICAL CONSIDERATIONS. J. W. Heyd and K. C. Jordan. Dec. 1, 1954. 8p. Contract [AT-33-1-GEN-53]. (MLM-CF-54-12-1).

Design considerations, properties, and applications of the thermal battery are discussed. The thermal battery utilizes thermocouples as voltage sources, one junction of a thermocouple being heated by a radioactive source. Batteries can probably be constructed with open circuit voltages up to 1.9 v and power outputs up to 24 w. The radioactive isotopes that most nearly meet ideal requirements for the thermal battery are Po^{210} and Sr^{90}. (M.P.G.)

1840 NP-5846
Carnegie Inst. of Tech., Pittsburgh.
THERMAL ASPECTS OF GALLING OF DRY METALLIC SURFACES IN SLIDING CONTACT. Technical Report No. 5. E. Saibel and F. F. Ling. Nov. 1955. 26p. Contract DA-36-061-ORD-495. Project 5B99-01-004.

The phenomenon of galling or seizing of metals is believed to be, in general, a function of the thermal and mechanical conditions under which the metallic surfaces are rubbed together. For polished surfaces, under ideal dynamic conditions, i.e., conditions where the surfaces are devoid of appreciable oscillations in the direction normal to the surfaces, thermal aspects of galling predominate. Galling due to thermal conditions is viewed as that condition where the tips of surface asperities weld together by recrystallization welding and are then sheared apart. The galling criterion, relating normal load, velocity, and time of rubbing, is established theoretically. The result compared favorably with experience. (auth)

1841 AEC-tr-2357
CERTAIN QUESTIONS IN THE THEORY OF PROPAGATION OF RADIO WAVES IN THE IONOSPHERE IN CONNECTION WITH ITS ERRONEOUS TREATMENT BY V. N. KESSENIKH. V. L. Ginzburg. Translated from Zhur. Eksptl'. i Teoret. Fiz. 25, 498–508(1953). 12p. Available from Associated Technical Services (Trans. 07G7R), East Orange, N. J.

The nature of the errors made by V. N. Kessenikh in his book "The Propagation of Radio Waves" (published in Russian) is analyzed in detail. (M.P.G.)

1842
THE HEATS OF FORMATION OF SOME TRANSITION METAL SILICIDES. D. A. Robins and I. Jenkins (General Electric Co., Ltd., Wembley, England). Acta Met. 3, 598–604(1955) Nov.

A method is described for determining the heats of formation of highly stable metal silicides and data are given for the following compounds: —Ti_5Si_3, $TiSi$, $TiSi_2$, Zr_5Si_3, $ZrSi$, $ZrSi_2$, $ThSi_2$, $V2Si$, Ta_5Si_3, $TaSi_2$, $MoSi_2$, and WSi_2. The highest heats of formation are those of com-

pounds containing Group IVa metals and, in general, the disilicides are not as stable as compounds containing a lower percentage of silicon. An analysis of the bond lengths in the disilicides is carried out and a comparison is made between the heats of formation data and changes in the character of the metal bonding. (auth)

1843

INVESTIGATION OF THE ION ADSORPTION BY WATER DROPS. Ts. G. Breido. Izvest. Akad. Nauk S.S.S.R. Ser. Geofiz. No. 6, 521-8(1955) Nov.–Dec. (In Russian)

The results are given for the experimental study of the charge relations occurring in a water drop from falling in a stream of ionized air; from the concentration and diffusion coefficient of ions of both charges of the air; or from the velocity of the motion and the radius of the drop. The data obtained proved that the ion diffusion acts as the basis charging mechanism for the water drops in weak electrical fields. (tr-auth)

1844

PHOTOEFFECTS OF THE ANTIMONY–CESIUM CATHODES SENSITIZATION BY OXYGEN. B. I. Dyatlovitzkaya. Zhur. Tekh. Fiz. 25, 2264-76(1955) Nov. (In Russian)

Sensitization effects on Sb–Cs and Bi–Cs cathodes by oxygen and by sulfur and selenium as a surface phenomenon originating from the lowering of the potential barrier, or as a phenomenon of the basic changes in the contents of the intermediate layer, are discussed. The explanations of the basic laws and the choice between the two points of view are offered. (R.V.J.)

1845

THE DETERMINATION OF ATOMIC WAVE FUNCTIONS. Louis C. Green (Haverford Coll., Penna.). pp.72-9 of "Proceedings of the National Science Foundation Conference on Stellar Atmospheres," held at Indiana Univ. Sept. 30, Oct. 1 and 2, 1954.

The recent work done on the accurate determination of atomic wave functions is reviewed. (B.J.H.)

AEROSOLS

USNRDL-TR-61
Naval Radiological Defense Lab., San Francisco.
CASCADE FILTRATION THEORY: A BASIS FOR STUDYING SUSPENDED PARTICLES. J. M. McCampbell. Aug. 19, 1955. 18p. Project NS 083-001. (AFSWP-905)

A method is suggested for measuring the radioactivity of fall-out particles in atomic clouds as a function of their size. This method consists of drawing the particles through a bank of filters in series and measuring the radioactivity retained on each filter. Reduction of these data to the desired distribution function is indicated by a matrix equation. (auth)

COSMIC RADIATION

1847

COSMIC-RAY EXPERIMENTS WITH A PROTON VELOCITY SELECTOR. K. W. Ogilvie (National Research Council, Ottawa, Canada). Can. J. Phys. 33, 746-56(1955) Dec.

Experiments with a selector of slow heavy cosmic-ray particles are described. The pressure coefficient of protons

at sea level in the momentum region 700 to 1100 Mev/c is found to be $0.64 \pm 0.08\%$ per mb. Points are obtained on the differential momentum spectrum of protons at sea level between 650 and 1250 Mev/c, in agreement with the results of Mylroi and Wilson (Proc. Phys. Soc. A64, 404(1951)). This spectrum is discussed in connection with the experiments of Filthüth between 200 and 900 Mev/c. (auth)

1848

TRIPLETS IN COSMIC RADIATION. Madeleine Avan and Louis Avan. Compt. rend. 241, 1284-6(1955). November 7. (In French).

Calculations were made of the effective cross section for the production of triplets by electrons. A study was also made of the variation of the cross section with the energy of the primary electron. (B.J.H.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1849 KAPL-1301
Knolls Atomic Power Lab., Schenectady, N. Y.
SOME FACTORS IN THE RESISTANCE OF CRYSTALS TO RADIATION DAMAGE. C. W. Tucker, Jr. and P. Senio. Mar. 24, 1955. Decl. Oct. 6, 1955. 17p. Contract W-31-109-Eng-52.

X-ray-diffraction studies of radiation damage in crystals indicate that the following factors are important in determining the radiation stability of a given material: homogeneity of damage, particle size, cleavage or fracture strength, grain boundaries, temperature, and bond size. (C.W.H.)

1850

NOTE ON THE CRYSTAL STRUCTURE OF NIOBIUM DIOXIDE. Arne Magnéli, Georg Andersson, and Gustav Sundkvist (Univ. of Uppsala, Sweden). Acta Chem. Scand. 9, No. 8, 1402(1955).

Tetragonal unit cell dimensions of $a = 2\sqrt{2}a_r = 13.71A$ and $c = 2c_r = 5.985A$ where $a_r = 4.846A$ and $c_r = 2.993A$ are the dimensions of a rutile-type subcell have been obtained for NbO_2 from powder pattern studies. (C.W.H.)

1851

THE STRUCTURE OF $MoBe_{12}$. Richard F. Raeuchle and Fred W. von Batchelder (Naval Research Lab., Washington, D. C.). Acta Cryst. 8, 691-4(1955) Nov.

The structure of $MoBe_{12}$ has been determined. Formal valences of 3.36 for molybdenum and 1.85, 2.27, and 2.59 for beryllium have been calculated using Pauling's single-bonded metallic radii, and are interpreted in terms of electron shift. (auth)

1852

NEUTRON SCATTERING AND THE FREQUENCY DISTRIBUTION OF THE NORMAL MODES OF VANADIUM METAL. B. N. Brockhouse (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Phys. 33, 889-91(1955) Dec.

The energy distributions of monoenergetic neutrons scattered by vanadium metal were measured at various temperatures, and resultant cross sections are shown. The results can be satisfactorily accounted for by a Debye model for vanadium. (B.J.H.)

Refer also to abstract 1814.

ELECTRICAL DISCHARGE

1853   UCRL-4560
California. Univ., Livermore. Radiation Lab.
LIQUID-SODIUM INSTABILITY EXPERIMENT. PART I.
Stirling A. Colgate. Sept. 30, 1955. 20p. Contract W-
7405-eng-48.

A magnetohydrodynamic model of a plasma-magnetic
field instability, using liquid Na, has been observed. The
growth rate and wave length of the Taylor-type accelera-
tion instability was observed to be in agreement with the
theory of Kruskal and Schwarzschild. (auth)

1854
CRITICAL EXAMINATION OF THE THEORY OF PLASMAS
BASED ON THE MEAN FREE PATH, BY KNOWLEDGE OF
THE METHOD RELYING ON THE DISTRIBUTION FUNC-
TION SOLUTION OF BOLTZMANN'S EQUATION. R. Jancel
and T. Kahan. J. phys. radium 16, 822-8(1955) Nov. (In
French)

The superiority of the method of distribution functions
over that of the mean free path is shown by examining
various characteristic examples in the theory of plasmas
and by showing the evident deficiencies in the mean free
path method. Also, various objections regarding previously
obtained results are answered. (tr-auth)

ELECTRONS

1855
SECONDARY ELECTRON EMISSION OF THE MONO-
CRYSTALLINE ALKALI HALIDE COMBINATIONS. A. R.
Shul'man and B. P. Dement'ev. Zhur. Tekh. Fiz. 25,
2256-63(1955) Nov. (In Russian)

Laboratory studies of the secondary emission properties
of alkali halide crystals are made with the purpose of
investigating the basic laws for the secondary electron
emission. (R.V.J.)

GASES

1856
WORK FUNCTION OF ION PAIRS IN POLYATOMIC GASES
FOR Po α PARTICLES. C. Biber, P. Huber, and A. Müller.
Helv. Phys. Acta 28, 503-21(1955) Nov. (In German)

In an earlier work, the absolute values of the work function
of ion pairs by Po α particles in some gases were deter-
mined. In this work such measurements are made on a
wider range of polyatomic gases, for which essentially the
same experimental arrangement can be used. The pre-
viously occurring anomalous pressure dependence of the
saturation curve of CO_2 is investigated further. (tr-auth)

Refer also to abstract 1940.

INSTRUMENTS

1857   HW-39170
Hanford Atomic Products Operation, Richland, Wash.
FLUID INTERFACE MONITORING BY CAPACITANCE
PROBE METHOD. C. A. Simsen. Sept. 23, 1955. 21p.
Contract W-31-109-Eng-52.

An all-electronic method of remote monitoring the inter-

face between two immiscible fluids is described. Its
development for a particular Hanford Atomic Products
Operation application is given, and requirements for use
in other applications are included. (B.J.H.)

1858   NARF-55-72T
Consolidated Vultee Aircraft Corp., Fort Worth, Tex.
OPERATION AND INSTRUCTION MANUAL FOR THE NTA
NUCLEAR INSTRUMENT CONTROL CONSOLE. Dec. 5,
1955. 26p. Contract AF33(038)-21117. (MR-N-104)

1859   UCRL-2879
Detroit Controls Corp., Redwood City, Calif.
DEVELOPMENT OF A MERCURY JET SWITCHING SYS-
TEM. FINAL REPORT. W. R. Davis and J. H. Deery.
Jan. 17, 1955. 49p. [For Radiation Lab., Univ. of Calif.,
Berkeley. Contract W-7405-eng-48]. (RU-30)

A high speed commutating and/or sampling switch for
monitoring each of 120 separate circuits 60 times per sec
or faster is described. By using the switch rotor as a self-
primed centrifugal pump, a jet stream of Hg is created
which continuously emanates from a central pool of Hg
(the pole of the switch) contained in the switch rotor. This
jet stream is caused to sequentially contact pins located
circumferentially around the switch stator, thereby con-
necting each pin in succession to the pole. Dwell times on
each contact are adjustable in the region of 100 μsec per
sample. Gravity is utilized to collect the Hg from the jet
in a sump in the stator, and the Hg is introduced again by
2 helical scoops to the input of the centrifugal pump, thus
completing the Hg cycle. In addition to its high sampling
rate, this switch is characterized by a lack of contact
bounce phenomena and by the potential of hundreds or
thousands of hours of continuous trouble-free operation.
Also described is a method of electronically synchronizing
two such switches that are remotely located (that is, not
mechanically coupled by virtue of a common shaft). (auth)

1860
A REMOTELY OPERATED EXTENSOMETER. R. G.
Berggren and J. C. Wilson. ASTM Bull. No. 210, 35-
8(1955) Dec.

An extensometer primarily developed to enable strain
measurements to be made by remote control is described.
Several unique features are of potential value in conven-
tional tension testing. The extensometer, mounted on a grip
or crosshead, is always ready for use and may be applied
to and removed from the specimen at any time during the
test. It is adaptable to a variety of specimen shapes and
sizes without modification. All strain magnification is ob-
tained electronically, resulting in considerable flexibility
of operation as regards magnification and range changes
during the course of a test or before the start of a test.
The extensometer also has a long range with high magnifi-
cation. (auth)

1861
ON STARTING ROUTINES FOR THE C.S.I.R.O. MARK I
COMPUTER. G. W. Hill and T. Pearcey (C.S.I.R.O.,
Sidney, Australia). Australian J. Phys. 8, 412-16(1955)
Sept.

In starting computers where no stored commands exist,
additional equipment is required. The routine for such
starts for the C.S.I.R.O. Mark I is outlined. (D.E.B.)

1862
PRECISION TIME-DELAY. Warren C. Struven (Univ. of

California, Berkeley). Electronics 28, No. 11, 218-20 (1955) Nov.

The circuit diagram and an operations description of a precision time-delay system are given. A circuit with a stability of 1 part in 1000 over a delay range of 150 msec to 2.5 sec is required. The circuit has a lower limit of 3 msec and an upper limit restricted only by the maximum value of the timing capacitor used. (D.E.B.)

Refer also to abstracts 1839 and 1886.

ISOTOPE SEPARATION

1863 TID-5217
California. Univ., Berkeley. Radiation Lab.
ELECTROMAGNETIC SEPARATION OF ISOTOPES IN COMMERCIAL QUANTITIES. R. K. Wakerling and A. Guthrie, eds. June 1949. Decl. Apr. 15, 1955. 434p. Contract W-7405-eng-48.

Papers have been selected and compiled for the purpose of giving a complete picture of the history and development of electromagnetic isotope separation. Calutron considerations, space charge and beam plasma, magnetic shimming, electric focusing, accelerating electrode focusing, the isotron, the ionic centrifuge, radial magnetic separators, resonance separation, and grid-slit systems are discussed. (D.E.B.)

1864 AEC-tr-2356
NEW POSSIBILITIES FOR ISOTOPE SEPARATION BY MEANS OF ION EXCHANGERS. Gerhard Dickel. Translated by I. A. Warheit from Z. Elektrochem. 54, 353-7 (1950). 17p.

A general discussion is given of synthetic resins which have a selective power of separation for different cations. The theory of selective exchange is discussed in detail, including the fundamentals, the theory of multiplication, separation in the residual process, and separation in the countercurrent process. (B.J.H.)

MASS SPECTROGRAPHY

1865
A DOUBLE-FOCUSING APPARATUS APPLICABLE TO COMMON MASS SPECTROMETERS. René Vauthier. Compt. rend. 241, 1388-91(1955). November 14. (In French).

Sources of non-homogeneous energies of the marginal trajectory ions with energies higher than the central trajectory ions are discussed. A double-focusing apparatus is proposed to provide a simple source of common ions. (R.V.J.)

1866
ON OPTIMUM METHOD FOR AUTOMATIC DEVELOPMENT OF MASS SPECTRA. V. L. Tal'pose. Zhur. Tekh. Fiz. 25, 2280-1(1955) Nov. (In Russian)

The method of determination of optimum law for minimum time of exposure is given. The calculations indicate a considerable gain in mass spectra registration time in cases when the exponential method was used with simultaneous rapid separation between lines. (R.V.J.)

1867
THE SYSTEM OF AUTOMATIC MAGNETIC DEVELOPMENT OF MASS SPECTRA. L. L. Dekabrun and A. K.

Lubimova. Zhur. Tekh. Fiz. 25, 2282-5(1955) Nov. (In Russian)

The problem of magnetic exposure was solved by development of an analytical mass spectrometer based on the principle of the MC-1 spectrometer in which the overlapping of the mass range of 12 to 200 with the voltage acceleration of 1900 v require the change of current from 20 to 140 ma in the mass separator electromagnet. Rigid stabilization of the current in the electromagnet was adapted to eliminate the fluctuation of the magnetic field. The diagram of the Hipple scheme, the scheme of wide range smooth exposure, and the complete scheme of exposure by the exponential law with automatic switching for the speed time of exposure are given. (R.V.J.)

MATHEMATICS

1868 AECU-3078
Division of Reactor Development. Naval Reactors Branch, AEC.
A BIBLIOGRAPHY OF AVAILABLE DIGITAL COMPUTER CODES FOR NUCLEAR REACTOR PROBLEMS. A. Radkowsky and R. Brodsky. Oct. 14, 1955. 114p.

A listing of reactor digital computer codes presently available or in preparation is provided. The codes are for digital computers of the size of the Card Programmed Calculator (CPC) or larger. The responsible laboratory, cognizant engineer, references, and problem status are also listed. (M.P.G.)

1869
RATE OF CONVERGENCE OF MADELUNG SERIES BY THE METHOD OF BERTAUT. David H. Templeton (Univ. of California, Berkeley). J. Chem. Phys. 23, 1629-30(1955) Sept.

A calculation is made of the correction to be applied to the Madelung constant when computed by a method given by Bertaut with a finite number of terms. (auth)

1870
EXTENSION OF McDOUGALL-STONER TABLES OF THE FERMI-DIRAC FUNCTIONS. A. C. Beer and M. N. Chase (Battelle Memorial Inst., Columbus, Ohio) and P. F. Choquard (Battelle Memorial Inst., Geneva). Helv. Phys. Acta 28, 529-42(1955) Nov. (In English)

The McDougall-Stoner tables of the Fermi-Dirac functions $F_k(\eta)$ for $k = -\frac{1}{2}$, $\frac{1}{2}$, and $\frac{3}{2}$ have been extended to include $k = \frac{5}{2}$, $\frac{7}{2}$, $\frac{9}{2}$, and $\frac{11}{2}$. Computations were carried out on digital computing equipment, using three terms of the Euler-Maclaurin numerical integration formula. Values are tabulated for the argument $\eta = -4$ (0.1) 20. Analysis of results, including use of numerous check points, suggests that the tables are accurate to five significant figures throughout. In order to provide a complete listing, the McDougall-Stoner values for $F_{-\frac{1}{2}}(\eta)$, $F_{\frac{1}{2}}(\eta)$, and $F_{\frac{3}{2}}(\eta)$ are also included in the tabulations. (auth)

Refer also to abstract 1861.

MEASURING INSTRUMENTS AND TECHNIQUES

1871 NRL-4643
Naval Research Lab., Washington, D. C.
COUNTING PULSED NEUTRON FLUXES IN THE PRESENCE OF PULSED X-RAYS. Allen Brodsky and

William J. Willis. Sept. 16, 1955. 10p. Project NR 662-120.

A method is described for determining pulsating fluxes of neutrons in the presence of pulsating x rays by the use of proportional counters with high neutron-to-gamma pulse height ratios. Typical curves of response to x-ray and neutron pile-up are given, and a theoretical calculation of response to x-ray pile-up from pulsed sources is shown to agree with experimental measurements. It is thus found that these calculations may be used to determine the response of a neutron counter to pulsed x rays, and thereby to establish the conditions for measuring pulsed neutrons in the presence of pulsed x rays. The techniques described are particularly suitable for expediting health physics surveys, but are also applicable to other experiments with pulsed radiations. (auth)

1872   UCRL-4516

California. Univ., Livermore. Radiation Lab.
THE UCRL PLASTIC FLUOR. Louis F. Wouters. Sept. 16, 1955. 30p. Contract W-7405-eng-48.

A solid-solution organic fluor suitable for scintillation counters can be manufactured by a process developed at the University of California Radiation Laboratory, Livermore. Small quantities of p-terphenyl and tetraphenylbutadiene are dissolved in styrene, which is then polymerized under controlled temperature in a nitrogen atmosphere. Fluor blocks of large dimensions have been produced by this method. (auth)

1873

THE USE OF SHORTER WAVELENGTHS IN X-RAY DIFFRACTION IN RELATION TO SCINTILLATION COUNTING. J. C. M. Brentano (Northwestern Univ., Evanston, Ill.). Acta Cryst. 8, 659-61(1955) Nov.

After referring to the advantages of scintillation counting discussed in earlier papers, in particular to the high yield it offers in the Mo K range, the conditions are discussed which a crystal-counter powder goniometer must satisfy in order to be adapted to the small deflection angles encountered with short wavelengths and to be free of aberrations which depend on the individual powder specimen and setting and which therefore cannot be allowed for on general terms. Two arrangements complying with these conditions are described. (auth)

1874

LIQUID SCINTILLATION COUNTER FOR CARBON-14 EMPLOYING AUTOMATIC SAMPLE ALTERNATION. Arthur J. Weinberger, Jackson B. Davidson, and Gus A. Ropp (Oak Ridge National Lab., Tenn.). Anal. Chem. 28, 110-12(1956) Jan.

A scintillation counter for C^{14}, which uses solution phosphors, has been described. This instrument has been used to measure the activity ratio of a pair of C^{14}-containing solutions with an average deviation of approximately 0.5% from the mean and from the calculated value. It employs automatic alternate counting of three cells, one of which is usually a standard and one a background. The alternating feature was designed to reduce possible effects of instrument drift and changing background on the results from long counting periods. A series of experiments to test this feature is reported. The counter is simple, electronically. The mechanical parts are not difficult nor expensive to build where adequate shop facilities are available. (auth)

1875

GAS COUNTING TECHNIQUES IN BIOCHEMISTRY. II. R. F. Glascock (Univ. of Reading). Atomics 6, 363-9(1955) Dec.

Butane is recommended as a medium for tritium assay. The advantages of using butane are summarized, and techniques for tritium determination are outlined. Some applications of gas counting in biochemical research are briefly discussed. (M.P.G.)

1876

RUSSIAN GEIGER COUNTERS. COMMENTS ON SOVIET EXHIBITS AT THE GENEVA ATOMIC EXHIBITION. Atomics 6, 386-8(1955) Dec.

A picture of 38 Russian counters is presented along with very brief descriptions and comments. (M.P.G.)

1877

THE DESIGN OF A MULTIPLE-WIRE PROPORTIONAL COUNTER AND ITS USE IN THE STUDY OF THE α-PARTICLES FROM THE REACTION ^7Li + p. A. C. Riviere and P. B. Treacy (Australian National Univ., Canberra). Australian J. Phys. 8, 408-12(1955) Sept.

Construction and performance are described. A 5.3-Mev α particle gave 7.65×10^5 ion pairs when an atmosphere of A and a voltage of 720 V were used. This represents an amplification factor of 4.7. Alpha spectra from Li^7 + p reactions are plotted. (D.E.B.)

1878

A PROPORTIONAL COUNTER WITH GRID CONTROL. R. J. Norman (Univ. of Melbourne). Australian J. Phys. 8, 419-24(1955) Sept.

A method of eliminating end effects is advanced in which a grid system of fine wires completely surrounds the anode wire. The effective counter diameter ratio is obtained while the full counter diameter is still available for electron collection. (D.E.B.)

1879

ON DIFFERENT PREPARATIONS OF EMULSIONS SENSITIVE TO CHARGED PARTICLES. Francois Simon. Compt. rend. 241, 1564-7(1955) Nov. 28. (In French)

Various classical procedures for the preparation of sensitive emulsions are studied and compared. A new and practical operating method for producing fine-grain emulsions is suggested. The influence of different physical factors is shown. (tr-auth)

1880

THE UNIT OF X-RAY DOSE AND ITS REALISATION. I. THE STANDARDISATION OF X-RAY DOSEMETERS. E. E. Smith (Downs Hospital, Sutton, Surrey, England). Brit. J. Radiol. 28, 662-9(1955) Dec.

An account is given of errors which have been revealed in the primary standard free-air chamber of the National Physics Laboratory and of the effect of these errors on clinical dosimetry in Great Britain. Inconsistencies in clinical dosemeters are discussed and the desirability of radioactive checks for secondary standard instruments is emphasised. Some details of the new N.P.L. free-air standard are presented, together with the preliminary results of an intercomparison with the standard chamber of N.B.S. The major sources of error in free-air chamber dosimetry are discussed and the conclusion reached that an absolute accuracy of better than ±1% is difficult to achieve in the conventional therapy region. Possible methods of

standardizing dosemeters in the high-energy (2 Mev) region are described and attention is drawn to the desirability of further work being done on the γ-ray of materials suitable for cavity chambers. (auth)

1881

THE UNIT OF X-RAY DOSE AND ITS REALISATION. II. THE PATIENT AND THE RÖNTGEN. PART I. M. Cohen (London Hospital). Brit. J. Radiol. 28, 669-77(1955) Dec.

The problem involved in translating radiation dosage determinations made in the laboratory to the patient is reviewed. Data are presented from recent measurements of depth doses, and methods for dosage determinations of x radiation are discussed. (C.H.)

1882

THE UNIT OF X-RAY DOSE AND ITS REALISATION. II. THE PATIENT AND THE RÖNTGEN. PART II. Geoffrey Boden (London Hospital). Brit. J. Radiol. 28, 677-82(1955) Dec.

The importance of a knowledge of radiation dose and dose distribution in the patients body in radiotherapy is stressed. Factors affecting patient reactions to radiation are discussed. Problems associated with obtaining uniformity in radiation dose are reviewed. (C.H.)

1883

THE UNIT OF X-RAY DOSE AND ITS REALISATION. III. PRACTICAL IMPLICATIONS OF THE 1953 RECOMMENDATIONS OF THE INTERNATIONAL COMMISSION ON RADIOLOGICAL UNITS. J. E. Roberts (Middlesex Hospital, London). Brit. J. Radiol. 28, 682-7(1955) Dec.

No attempt has been made to lay down detailed rules for the change from röntgens to rads in radiotherapeutic practice. An attempt only has been made to indicate that the problem is somewhat more complex than might be suggested by the disarmingly simple changes in the Recommendations of the International Commission of Radiological Units. Some suggestions have been made as to the first and simpler steps which might be taken to put the changes into practice. No statutory authority exists to enforce the changes and the responsibility now lies with the radiotherapists, radiobiologists and physicists. (auth)

1884

CALIBRATION OF SCINTILLATION SPECTROMETER WITH γ-RAYS FROM Ra AND Mn^{56}. M. Garcia Muñoz and D. Maeder. Helv. Phys. Acta 28, 359-61(1955) Aug. (In German)

1885

PROPORTIONAL COUNTER FOR THE MEASUREMENT OF WEAK ACTIVITIES OF SOFT β RAYS. F. G. Houtermans and H. Oeschger. Helv. Phys. Acta 28, 464-6(1955) Nov. (In German)

1886

A NEW LATTICE SPECTROGRAPH WITH PHOTO-ELECTRIC REGISTERS FOR THE SCHUMANN REGION. E. Lüscher. Helv. Phys. Acta 28, 492-4(1955) Nov. (In German)

1887

IONIZATION MEASUREMENT IN SLANTING TRACKS IN NUCLEAR EMULSIONS. H. Winzeler. Helv. Phys. Acta 28, 497-502(1955) Nov. (In German)

A simple relation, which allows the ionization for strong slanting tracks to be determined easily, is given and dis-

cussed on the basis of the "mean gap length". The proof is made with high-energy α particles. (tr-auth)

1888

ON THE ENERGY RESPONSE AND RESOLUTION OF A SCINTILLATION COUNTER. Sobhana Dhar (Univ. Coll. of Science, Calcutta). Indian J. Phys. 29, 329-51(1955) July.

The experimental investigations on the energy response, resolution and figure of merit of a scintillation counter using different phosphors are reported. The observations have been taken with the help of a 180°M-F spectrometer set up as an energy selector and the results are obtained for the phosphors NaI-Tl, anthracene, stilbene, terphenyl and plastifluor B under excitation by monoenergetic electrons ranging from 100 kev to 1.1 Mev. From the experimental data, shows a linear behaviour in the entire energy range investigated while anthracene, stilbene and terphenyl seem to give linear responses above 160, 120 and 240 kev respectively. The plastic phosphor is non-linear up to about 800 kev. The relative responses of the different phosphors to monoenergetic electrons are obtained under similar experimental conditions. The pulse height distributions for all the phosphors are found to be approximately of Gaussian nature. With the help of experimental data, the figure of merit and the energy required to produce one photon have been calculated for different phosphors. The pulse height resolutions for the phosphors have been computed from the experimental results and the inverse pulse height resolutions are plotted against pulse heights. The relative response curves and the inverse resolution versus pulse height curves reveal the comparative value and the usefulness of a particular phosphor in the spectrometry of nuclear radiations. (auth)

1889

CHARACTERISTICS OF THE OPTICAL MOUNTING OF A SCINTILLATOR. Yves Koechlin. J. phys. radium 16, 849-53(1955) Nov. (In French)

The problem of optical coupling of a scintillator on a photomultiplier is studied. In particular, a determination is made of the dependence of the portion of light from a scintillation reaching the photocathode on the scintillator covering, on its shape, and on the location of scintillation production in the scintillator. (tr-auth)

1890

DEVICE FOR SUBTRACTIVE COUNTING BY DEKATRON TUBES. A. Coche. J. phys. radium 16, 861-3(1955) Nov. (In French).

A description is given of a device permitting the subtraction of the numbers of impulses given by two Geiger-Mueller counters and using cold cathode bi-directional decade tubes. The dekatron impulses indicating ones or tens actuate and adding or subtracting numerator, by means of two triode-hexode switching circuits. (tr-auth)

1891

OPTICAL CEMENT FOR THE NaI(Tl) CRYSTALS. I. E. Pani. Zhur. Tekh. Fiz. 25, 2369-70(1955) Nov. (In Russian)

The series of by-products formed during the preparation of para-dicyclohexylbenzene from terphenyl proved to be suitable as optical cement materials. In combination with polystyrene they produce a highly viscous and transparent mass. (R.V.J.)

Refer also to abstracts 1846, 1847, and 1952.

MESONS

1892

ON THE POLARIZATION OF ELECTRONS DURING THE DECAY OF POLARIZED μ-MESONS. L. B. Okuv. Doklady Akad. Nauk S.S.S.R. 104, 840-2(1955) Oct. 21. (In Russian)

Calculations were made to determine the constant G_i, occurring in the equation describing μ-meson decay, by measuring the spin correlations of μ-meson decay and the electron escaping during the decay. (R.V.J.)

1893

RENORMALIZATION OF THE MESON PAIR THEORY. Walter Thirring. Helv. Phys. Acta 28, 344-5(1955) Aug. (In German)

1894

NUCLEAR INTERACTION OF K⁻-MESONS AT REST. E. Lohrmann, Ch. Peyrou, M. Teucher, and H. Winzeler. Helv. Phys. Acta 28, 346-7(1955) Aug. (In German)

1895

ON THE INTERPRETATION OF THE INTERACTION OF LOW ENERGY π MESONS. Walter Thirring. Helv. Phys. Acta 28, 591-616(1955) Nov. (In German)

The general properties of the meson-nucleon interaction and the higher order processes are discussed according to general laws of quantum theory. In the first section, those consequences which result from the spin and parity of the mesons for the act of emission and for the virtual meson field are discussed, assuming the validity of quantum theory for these phenomena. The next section gives a simple comparison of the various expected higher order phenomena with the corresponding experimental facts. In conclusion, the differences between meson theory and quantum electrodynamics are emphasized and are directed to difficulties in renormalization and in the definition of observed magnitudes in meson theory. The known results and theories are also partially quoted, in so far as they are useful to the understanding of the phenomena. (tr-auth)

MOLECULAR PROPERTIES

1896   NP-5843

Ohio State Univ. Research Foundation, Columbus. X-RAY DIFFRACTION STUDIES OF THE SOLID-LIQUID TRANSITION OF SODIUM METAL. Technical Report No. 3. Bernard A. Kulp, Charles H. Shaw, and Rudolph Speiser. Aug. 1955. 75p. RF Project 384. [ONR Project] NR 017 606. Contract N6onr-22521.

This material is taken from the Ph.D. thesis of Bernard A. Kulp.

The intensity of an x-ray-diffraction line of Na has been studied through the melting point of Na. The sample used in the experiments consisted of a dispersion of Na in mineral oil. The apparatus is described, and results are summarized. At the melting point, the intensity of the diffraction line was observed to drop sharply to the intensity of the liquid scattering pattern. The observations for both the melting and the solidification of the dispersed sample are explained as a particle size effect. Some important characteristics of the solidification of the sample were observed and are discussed. (M.P.G.)

1897   UCRL-2854(Rev.)

California. Univ., Berkeley. Radiation Lab. HEATS OF SUBLIMATION OF THE ELEMENTS. Leo Brewer. Nov. 1955. 8p. Contract W-7405-eng-48.

The heats of sublimation of the elements at 298°K to the various elemental gaseous species are tabulated. (auth)

1898

ON THE POLARIZATION THEORY OF RESONANCE EMISSION AND THE FLUORESCENCE OF ATOMIC AND DIATOMIC MOLECULES. P. P. Feofilov. Doklady Akad. Nauk S.S.S.R. 104, 846-9(1955) Oct. 21. (In Russian)

Calculations are given for the degree of polarization of the resonance emission and the atomic fluorescence as a function in the J levels of the quantum numbers between the transitions defining the luminescence process. (R.V.J.)

NEUTRONS

1899

ENERGY AND ANGULAR DISTRIBUTIONS OF PHOTO-NEUTRONS PRODUCED BY 70-MEV X-RAYS. W. R. Dixon (Queen's Univ., Kingston, Ontario, Canada). Can. J. Phys. 33, 785-96(1955) Dec.

The angular distributions of the photoneutrons produced by 70-Mev x rays in seven elements have been measured with a zinc sulfide—lucite scintillation detector. For the heavy elements, the distributions are essentially isotropic, indicating the predominance of the evaporation process, while for the light elements there is also an anisotropic component peaked at 90°. The energy distributions of the photoneutrons produced in copper and lead targets have been determined with nuclear emulsions. It is shown that most of the neutrons can be attributed to an evaporation process which is governed by a constant nuclear temperature, the temperature found for copper being 1.2 Mev, and for lead being 1.0 Mev. A high-energy tail on the energy distributions is attributed to direct interactions. (auth)

1900

PRODUCTION OF MONOENERGETIC d-d NEUTRONS WITH THE AID OF n-He³ COINCIDENCES. W. Franzen, P. Huber, and L. Schellenberg. Helv. Phys. Acta 28, 328-31(1955) Aug. (In German)

1901

ANGULAR DISTRIBUTION AND POLARIZATION OF SCATTERED NEUTRONS OF 3.4 MEV BY Pb AND Bi. H. R. Brugger, H. J. Gerber, B. Lüthy, and A. E. Remund. Helv. Phys. Acta 28, 331-3(1955) Aug. (In German)

1902

INELASTIC SCATTERING OF NEUTRONS BY ROTATIONAL EXCITATION. Satio Hayakawa and Shiro Yoshida (Kyoto Univ., Japan). Progr. Theoret. Phys. (Japan) 14, 1-15 (1955) July.

The collective nuclear model of A. Bohr is applied to the interpretation of inelastic scattering of neutrons. The detailed theory of the inelastic scattering of neutrons by a direct excitation of the nuclear surface rotation, as well as by the resonance scattering via compound nuclei, is discussed. The cross section for the former process is proportional to the square of the intrinsic quadrupole moment and depends strongly upon the amplitudes of

neutron waves at the nuclear surface. This strong dependence makes it difficult to compare theory with experiments. Conversely the strong dependence may be employed to know the optical potential which distorts neutron waves. It is pointed out that the contributions from the direct and compound nucleus forming processes can be distinguished by observing the angular distribution. (auth)

NUCLEAR PHYSICS

1903   AECU-3121

Massachusetts Inst. of Tech., Cambridge. Lab. For Nuclear Science.
PROGRESS REPORT [NO. 37 FOR THE PERIOD OF JUNE 1, 1955 THROUGH AUGUST 31, 1955]. Aug. 31, 1955. 83p. Contracts AT(30-1)-905 and N5ori-07806.

Results from a study of the behavior of the glass electrode in absolute ethanol are reviewed. Experimental results on the extraction of Te(IV) from hydrochloric acid solutions into β, β'-dichloroethyl ether are tabulated. Extraction coefficients for gold(III) between HCl and several organic solvents are also given. The ionization constant of HCl in β, β'-dichlorodiethyl ether was found to be $1.7 \pm 0.5 \times 10^{-7}$. A detailed study was made on the fission products occurring in the valley region of masses 103 to 131. The extraction of Cs from aqueous solutions of sodium tetraphenylboride into organic solvents was studied. Decay properties of Ag^{111m} were studied. The study of tritium isotope effects in the enolization of ketones was continued. A trigger scheme for detecting heavy unstable cosmic particles is described. Energy levels in isotopes of samarium, europium, gadolinium, and terbium were studied by electric excitation with protons. Results are tabulated, and typical pulse height spectra are shown. The $O^{16}(d,\alpha)N^{14*}$ reaction was studied. Preliminary results on the inelastic scattering of protons from indium were obtained. Energy levels in Ge^{72} were also studied. The operation and maintenance of the synchrotron is reviewed. Results on the study of the photoproduction of π^+ mesons from H are given. Results of a large stock exposure to the K^+ beam at Berkeley are summarized. Differential cross sections for the elastic photoproduction of π^0 mesons from deuterium are given. A theoretical study was made on the angular and energy distribution of τ decay products. Energy distribution and angular correlations of the π mesons from τ^+ decay were studied experimentally. (For preceding period see AECU-3110.) (B.J.H.)

1904

DEVIATIONS FROM THE ADDITIVE LAW IN THE BREMSSTRAHLUNG OF α PARTICLES. L. Chollet and J. Rossel. Helv. Phys. Acta 28, 466-70(1955) Nov. (In French)

1905

ON THE DEVIATION OF MAGNETIC MOMENTS OF S NUCLEI FROM THE SCHMIDT LIMITS. M. L. Chaudhury (Indian Assoc. for the Cultivation of Science, Calcutta). Indian J. Phys. 29, 319-28(1955) July.

The present attempt to explain the deviations of the magnetic moments of the $S_{1/2}$ - nuclei from the Schmidt limits, is based on the assumption that this deviation is essentially due to the change in the intrinsic magnetic moment of the last odd particle as a result of exchange of vector mesons between it and the adjacent nucleons of the

core. The exchange moment has been calculated by the usual perturbation method. The agreement with experimental findings is discussed. (auth)

1906

THE NEGATIVE PROTON. D. H. Wilkinson (Cavendish Lab., Cambridge, England). Research (London) 8, 484-6(1955) Dec.

The experimental techniques used in the discovery of the negative proton are described, and the significance of the discovery discussed. (D.E.B.)

Refer also to abstracts 1893, 1963, and 1966.

NUCLEAR PROPERTIES

1907   IDO-16226

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
NEUTRON ABSORPTION CROSS SECTION OF Pa^{233}. R. R. Smith, T. O. Passell, S. D. Reeder, N. P. Alley, and R. L. Heath. Oct. 27, 1955. 22p. Contract AT(10-1)-205.

The thermal neutron absorption cross section of Pa^{233} has been measured by determining the amounts of UX_2 (1.175 min) and UZ (6.7 hours) formed in a high flux irradiation of known amounts of Pa^{233}. The following values were found: for the formation of UX_2, $\sigma_{th} = 43 \pm 5$ barns; for the formation of UZ, $\sigma_{th} = 25 \pm 4$ barns, giving a total activation (or absorption) cross section of 68 ± 6 barns. If the data are analyzed on a basis of total activation (i. e. without a separation of the resonance neutron contribution) a value of 107 ± 10 barns is found for the total pile neutron cross section. Using the cadmium ratios found for Co and Pa^{233} the following values were estimated for the resonance activation integrals: for the formation of UX_2, $\int \sigma_E \, dE/E = 400$ barns; for the formation of UZ, $\int \sigma_E \, dE/E = 270$ barns. (auth)

1908

THE NEW ISOTOPES Cd^{104} AND Ag^{104}. F. A. Johnson (McGill Univ., Montreal, Canada). Can. J. Phys. 33, 841-55(1955) Dec.

Two new neutron-deficient isotopes Cd^{104} (59 min.) and Ag^{104} (27 min.) have been produced by the reaction $Ag^{107}(p,4n)Cd^{104}$ at 50 Mev in the McGill Univ. synchrocyclotron and by the subsequent growth of Ag from the Cd. These isotopes have been investigated by means of a 180° spectrograph of high resolution, a lens spectrometer, and a scintillation spectrometer. Chemical methods of identification have also been employed. Ag^{104} has been found to emit a positron spectrum of end point 2.70 ± 0.01 Mev and a γ ray of 556.2 kev which is thought to be in series with the positron spectrum. The origin of a γ ray of energy 118.4 kev which appears to be converted in Pd is at present unknown. A tentative decay scheme is proposed. Cd^{104} appears to decay primarily by K-capture since no positron spectrum was observed which could be assigned to this isotope. Four γ rays, of energies 66.7, 83.6, 123.6, and 134.2 kev, have been definitely assigned to this isotope on the basis of K−L differences shown by conversion lines; on the basis of relative L line intensities and K/L ratios the two low energy γ rays have been shown to represent M1 transitions. Other conversion lines were found whose origin and element of conversion are unknown. (auth)

1909

PRECISION MEASUREMENT OF SEVERAL (p,γ) RES-
ONANCES. F. Bumiller and H. H. Staub. Helv. Phys.
Acta 28, 355-6(1955) Aug. (In German)

1910

EXCITED STATE OF Be^8 IN THE REACTION $C^{12}(\gamma,\alpha)Be^8$.
H. Glättli, E. Loepfe, and P. Stoll. Helv. Phys. Acta 28,
366-8(1955) Aug. (In German)

1911

ABSOLUTE CROSS SECTION OF Pb FOR γ RAYS OF Co^{60}
AND Na^{24} AND ELECTRON PAIR PRODUCTION BY γ RAYS
OF Bi^{214} IN Pb. P. Schmid and P. Huber. Helv. Phys. Acta
28, 369-88(1955) Aug. (In German)

Using the method of detecting annihilation coincidences,
absolute cross sections in lead for the creation of electron
pairs by γ-rays have been determined at 1.3 and 2.75 Mev.
The sum of the cross sections for both γ-rays of Co^{60} is
found to be 0.274 ± 0.008 barns. This value is in good
agreement with earlier measurements and is 109% higher
than the value calculated from the Born approximation. The
value determined for the pair production cross section in
lead at 2.75 Mev is 3.18 ± 0.12 barns which is 12% higher
than calculated from the Born approximation. This agrees
with the numerical calculations of Jaeger and Hulme within
the limits of error. In addition, the pair production in lead
by γ-rays of RaC has been observed. It can be described by
the assumption that 0.480 quanta of energy 1.8 Mev and of
pair production cross section 1.25 ± 0.05 barns are emitted
per alpha ray of Ra. (auth)

1912

A METHOD FOR THE ANALYSIS OF COMPLICATED
NUCLEAR SPECTRA WITH THE AID OF THE DIRECTION
CORRELATION. P. Debrunner, E. Heer, and R. Rüetschi.
Helv. Phys. Acta 28, 473-5(1955) Nov. (In German)

1913

AN EXPERIMENT ON THE DETECTION OF ELECTRIC
16-POLE MOMENTS OF Cd^{113}. E. Heer and R. Rüetschi.
Helv. Phys. Acta 28, 525-8(1955) Nov. (In German)

An attempt has been made to find an interaction between
the electric field of a cubic crystal and the 16-pole moment
of the Cd^{111} nucleus (247 kev level) by means of angular
correlation methods. No remarkable effect has been ob-
served. Experimental results and a rough theoretical
estimation of the interaction energy are compared. (auth)

1914

NEUTRON YIELDS FROM AMERICIUM—BERYLLIUM
ALLOYS. O. J. C. Runnalls and R. R. Boucher (Atomic
Energy of Canada, Ltd., Chalk River, Ont.). Nature 176,
1019-20(1955) Nov. 26.

Two Am—Be alloys were prepared having atom ratios of
1:263 and 1:14. The respective neutron yields were 2.13 ±
0.02×10^5 and $1.57 \pm 0.02 \times 10^5$ n/sec. Methods of alloy
preparation and counting techniques are described. (D.E.B.)

1915

NEUTRONS PRODUCED IN THE BOMBARDMENT OF
BERYLLIUM BY DEUTERONS. Fedor Boreli and
Branislav Lalovic (Boris Kidrich Inst. of Nuclear Sciences,
Belgrade). Nature 176, 1021(1955) Nov. 26.

Measuring techniques and energy curves for the neutron
yield from the $Be^9(d,n)B^{10}$ reaction are given. (D.E.B.)

1916

ON BOUND Λ° PARTICLES. Ken-ichi Ono (Univ. of
Tokyo). Progr. Theoret. Phys. (Japan) 13, 522-8(1955)
May.

The binding of Λ° particles in nuclear fragments is
discussed in terms of the interaction which produces the
reaction $p + \pi^- \rightarrow \Lambda^\circ + \theta^\circ$. The binding energy of a Λ° in
an infinitely large nucleus is found to be about 2.3 Mev,
while, for the fragments of a finite radius, the lower limit
of the mass number A to bind a Λ° in them is found to be
$A^{1/2} > 2.9$. (auth)

1917

ON THE INTERMEDIATE COUPLING THEORY OF
PSEUDO-SCALAR MESON FIELD AND A NUCLEON.
Daisuke Ito, Yoneji Miyamoto, and Yukihiko Watanabe
(Tokyo Univ. of Education, Japan). Progr. Theoret. Phys.
(Japan) 13, 594-602(1955) June.

The properties of the proper field around a nucleon are
investigated by Tomonaga's theory of intermediate coupling
applied to the pseudo-scalar field. The phase shifts of
pion-nucleon scattering and the anomalous magnetic
moment of a nucleon are calculated. (auth)

1918

ON THE ANALYSIS FOR THE PROPER FIELD OF A
NUCLEON. Yukihiko Watanabe (Tokyo Univ. of Education).
Progr. Theoret. Phys. (Japan) 13, 603-11(1955) June.

Making use of the symmetrical scalar theory, various
approximations have been developed for analyzing the
properties of the proper fields of a nucleon. As this model
permits the exact numerical solution of the proper field
equation, it is possible to test the accuracy of newly
attempted approximation methods. The exact numerical
solution for the proper field of the nucleon is given. (auth)

1919

NUCLEAR STRUCTURE AS REVEALED BY ELECTRIC
EXCITATION. Clark Goodman (Massachusetts Inst. of
Tech., Cambridge). Progr. Theoret. Phys. (Japan) 14,
95-106(1955) Aug.

Electric excitation measurements of low-lying levels in
medium weight and heavy nuclei have been made from
which the energy ΔE of a given level and the cross section
σ_{ex} for its excitation can be deduced. Electric quadrupole
moments, $Q_0(\Delta E)$ and $Q_0(\sigma_{ex})$ respectively, based on these
two sets of data show markedly different values and
markedly different trends as the closed proton shells at
50 and 82 are approached. If it is assumed that the $Q_0(\Delta E)$
is indicative of the deformation of mass and $Q_0(\sigma_{ex})$ is
indicative of the deformation of charge, the results suggest
that a) the protons and neutrons are not uniformly distrib-
uted throughout the nucleus, b) the spherical symmetry of
the protons is greater than that of the neutrons near the
proton shells, c) the protons are concentrated closer to the
center of the nucleus than the neutrons, and/or d) the flow
within the nucleus is not purely irrotational. (auth)

1920

NUCLEAR MAGNETIC RESONANCE. E. R. Andrew.
New York, Cambridge University Press, 1955. 265p.
$6.50.

A comprehensive review of the subject has been attempted.
Topics covered include: basic theory; experimental
methods; measurement of nuclear properties; physical

applications; nuclear magnetic resonance in liquids, gases, nonmetallic solids, and metals; and quadrupole effects. (M.P.G.)

NUCLEAR REACTORS

1921   AECD-3668
Argonne National Lab., Lemont, Ill.
EXPERIMENTAL INVESTIGATION OF THE SELF-LIMITATION OF POWER DURING REACTIVITY TRANSIENTS IN A SUBCOOLED, WATER-MODERATED REACTOR. Borax-I Experiments, 1954. J. R. Dietrich. Decl. with deletions Aug. 17, 1955. 84p. Contract W-31-109-eng-38.

A series of experiments was made on the Borax-I reactor to investigate the ability of the reactor, when operated in the subcooled condition, to protect itself against the results of sudden, artificially induced increases in reactivity. Inasmuch as this set of experiments completed the program for the Borax-I reactor, the final runaway experiment was intentionally made under conditions which led to destruction of the reactor. In the final experiment a control rod worth 4% k_{eff} was ejected from the reactor core, inducing an exponential power increase of period 2.6 msec. The results of this final experiment when combined with those obtained in the preceding milder tests indicate the behavior of the reactor over a wide range of conditions of excess reactivity. The maximum power attained during the final experiment was determined to be between 13×10^9 and 20×10^9 w, and the total energy liberation was approximately 135 Mw-sec. This energy release resulted in melting of most of the fuel plates and failure of the reactor tank. Fuel plate fragments were scattered for a distance of 200 to 300 ft from the reactor, but no widespread dangerous dispersal was observed. (auth)

1922   AECD-3677
Hanford Atomic Products Operation, Richland, Wash.
EXPONENTIAL PILE MEASUREMENTS IN GRAPHITE-URANIUM LATTICES. E.-D. Clayton. June 1, 1954. Decl. Sept. 29, 1955. 108p. Contract W-31-109-Eng-52.

The results from a series of exponential experiments involving 30 graphite-uranium lattices are presented. The diameter of the slug was varied from 0.925" to 1.66", and measurements were also taken with one hollow slug (1.66 in. OD, 0.81 in ID). The lattice spacing was varied from $6\frac{3}{16}$ in. to 15 in. Both wet and dry lattice measurements were taken; that is, the lattices were measured with water and without water in the cooling annulus to determine the effect of the cooling water on the buckling or reactivity. The buckling values are given for various slug sizes and lattice spacings. The lattice diffusion lengths, utilization in the moderator, utilization in uranium, and multiplication constant are also listed for those lattices in which these quantities were determined. Calculated conversion ratios are given for all except the hollow slug size. (auth)

1923   AECL-259
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
REPROCESSING OF NUCLEAR FUELS. G. W. Hatfield. [1955]. 14p.

A general discussion of power reactor fuel reprocessing

is presented, including economic factors, types of fuels, and separation processes that have been used, are now being used, and ones recommended for future use. It is recommended that government and industry work together to develop processes which are sufficiently versatile to handle all possible types of fuels. (M.P.G.)

1924   IDO-16084
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
EFFECT ON FLUX OF A FUEL PLATE IN REFLECTOR. J. W. Webster and H. L. McMurry. Apr. 20, 1953. Decl. Sept. 28, 1955. 18p. Contract AT(10-1)-205.

The flux perturbation due to a 65-mil fuel plate, 10% enriched located in the Be reflector 25 cm from the core, has been calculated. The 65-mil thick plate was considered to be of the same dimensions as the core face in the other two directions for computational purposes. It was found that this thin plate of area equal to that of the core face would cause a reactivity increase of 2.3%, and that the thermal flux reduction caused by the plate at its inner edge is 22%, that is, the absorbing effect depresses the thermal flux more than the new fission neutrons tend to increase it. Although the thermal flux is thus not strongly affected, the fast flux is boosted rather markedly. It is increased by a factor of about 11.7 at the position of the inside edge of the plate. The thermal flux is not depressed to any great extent inside the fuel plate, being only 1% less at the middle than at the inside edge (based on the diffusion approximation). For the specific experiment in question, which employs three plates of area $1'' \times 6''$, the reactivity effect should be less than 0.1%. The local depression of thermal flux at the plate and the enhancement of fast flux at the plate should be somewhat less than that found for the plate with area equal to that of the entire core face. (auth)

1925   IDO-16214
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
TEMPERATURE DISTRIBUTION IN A FUEL PLATE WITH EXPONENTIALLY RISING POWER. PART I. THEORETICAL. H. L. McMurry. Mar. 25, 1955. 27p. Contract AT(10-1)-205. (PPC-1)

Equations are derived for the temperature distribution in a fuel plate within which the power rises exponentially on a short period. The fuel plate is infinite in 2 directions, clad with Al, and immersed in water. Differential equations for heat transfer are solved by means of Laplace transforms. (M.P.G.)

1926   KAPL-1414
Knolls Atomic Power Lab., Schenectady, N. Y.
ONE-GROUP CRITICALITY CONDITIONS FOR A BLACK ECCENTRIC CONTROL ROD. J. H. Smith and J. C. Stewart. Oct. 5, 1955. 18p. Contract W-31-109-Eng-52.

Three methods of deriving the one-group critical equation for a reactor containing a black off-center control rod are presented. All are shown to yield identical results. The groundwork is laid for the future analysis of multi-group, multirod problems. (auth)

1927   ORNL-1987
Oak Ridge National Lab., Tenn.
ANALYSIS OF SPHERICAL PRESSURE VESSEL HAVING AN ENERGY SOURCE WITHIN THE WALL. R. H.

Chapman. Oct. 26, 1954. 120p. Contract W-7405-eng-26. (CF-54-10-76)

A method is given for determining the optimum thickness of a spherical pressure vessel in which there is an exponential heat source contained within the vessel wall. The method has applications in the design of certain types of nuclear reactors. It is shown how the thermal stress may be estimated for thermal stress may be estimated for thermal reactors and combined with the pressure stress to obtain the total stress. The solution to a hypothetical design problem is given to illustrate the procedure. Some data are included which should be an aid in the solution of similar problems. (auth)

1928   TID-7001

Argonne National Lab., Lemont, Ill. and Oak Ridge
    National Lab., Tenn.

MATERIALS TESTING REACTOR PROJECT HANDBOOK.
John H. Buck and Carl F. Leyse, eds. May 7, 1951.
570p. Contract W-7405-eng-26.

A semi-detailed description of the reactor and reasons for the design are presented. Included in the handbook are chapters on: a general description of the reactor and its auxiliaries and an account of the administrative history of the project; the experimental facilities provided in the reactor; physics of the reactor; control of the reactor; and descriptions of the necessary auxiliary units and the reasons for their design. Information in the appendixes includes: description of background and experiments leading to the MTR; proposed facilities that may be built in the future; and general nuclear data. Extensive bibliographies and lists of reference drawings are given. (M.P.G.)

1929

CALCULATIONS FOR A 10-MW HEAVY WATER AND NATURAL URANIUM REACTOR. S. Gallone and C. Salvetti. Energia nucleare (Milan) 2, 493-5(1955) Oct. 15. (In Italian)

The principles of calculation for a 10 Mw heavy water natural uranium reactor are indicated. The graphs show the core volumes as a function of lattice parameters for a fixed reactivity as well as reactivity, also as a function of lattice parameters, for a fixed core volume. The thermal and mechanical conditions of final elements during operation are shown on the same graphs. (auth)

1930

COMPOSITION OF THE FUEL ELEMENT DURING THE OPERATION OF A THERMAL HETEROGENEOUS NATURAL URANIUM REACTOR. L. Mongini and C. Mongini Tamagnini. Energia nucleare (Milan) 2, 519-36(1955) Oct. 15. (In Italian)

The growth of the fission products (exclusive of Xe^{135} or Sm^{149}) with time, for average fluxes in uranium of 10^{12} neutrons/cm^2 sec and 10^{13} neutrons/cm^2 sec, is evaluated. It is therefore possible to calculate the dependence of the total macroscopic absorption cross section of the fission products on time of irradiation. In addition to the above, equations relating the atomic fractions of the various nuclides in the fuel to the time of irradiation are derived. Finally, the dependence of the operational time of a reactor upon the following parameters is shown: the average flux in uranium; a microscopic absorption cross section per each original fuel atom, which must artificially allow for the absorption of structural materials, moderator, Xe^{135}, Sm^{149}, control devices, and for neutron leakage. This

microscopic absorption cross section, through the neutron leakage, is strongly related to the reactor size. (auth)

1931

METALLURGICAL PROBLEMS IN DESIGN OF NUCLEAR POWER REACTORS. Vincent P. Calkins (General Electric Co., Cincinnati). Metal Progr. 68, No. 6, 73-6(1955) Dec.

A general discussion is given of factors which limit the selection of materials for use in nuclear reactors. Such factors include radiation damage, neutron absorption characteristics, and corrosion effects. The role of powder metallurgy in the fabrication of reactor materials is also discussed. (B.J.H.)

NUCLEAR TRANSFORMATION

1932

GAMMA RAYS FROM THE DEUTERON BOMBARDMENT OF BORON 10. J. T. Sample, G. C. Neilson, G. B. Chadwick, and J. B. Warren (Univ. of British Columbia, Vancouver, Canada). Can. J. Phys. 33, 828-40(1955) Dec.

Bombardment of B^{10} with 1.4 Mev deuterons has been found to produce γ rays of energy 4.46 ± 0.04, 4.75 ± 0.03, 5.03 ± 0.09, 5.35 ± 0.05, 6.52 ± 0.04, 6.78 ± 0.07, 7.29 ± 0.04, 8.27 ± 0.09, and 8.87 ± 0.02 Mev, as measured with a three-crystal pair spectrometer. Tentative assignments to transitions in B^{11} and C^{11} agree well in most cases with the known energy level schemes. No γ rays of very high energy were observed, even with a single-crystal spectrometer; consequently an upper limit of 10^{-31} cm^2 has been placed on the cross-section of $B^{10}(d,\gamma)C^{12}$ at 0.95-Mev bombarding energy. (auth)

1933

ON THE $O^{18}(\alpha,n)Ne^{21}$ REACTION. Radha Raman Roy, Alphonse Lagasse, Marie-Louise Goes, and René Moerman. Compt. rend. 241, 1567-8(1955) Nov. 28. (In French)

The $O^{18}(\alpha,n)Ne^{21}$ reaction was studied using a B^{10}-enriched BF_3 neutron counter. The excitation curve for this reaction is given. (tr-auth)

1934

THE Cu(n; 2n) EXCITATION FUNCTION AND THE KNOCK-OUT PROCESS IN NUCLEAR REACTIONS. Ryuzo Nakasima and Ken Kikuchi (Osaka Univ., Japan). Progr. Theoret. Phys. (Japan) 14, 126-34(1955) Aug.

The (n, 2n) excitation cross section in copper is calculated on the basis of the compound nucleus formalism. If the probability for the formation of the compound nucleus by the incident neutron is assumed to be equal to unity, the calculated cross section becomes much larger than the experimental one. When the knock-out process is taken into account and a smaller probability is adopted, the agreement with the experiment can be made better to some extent. The estimate of the cross section of the knock-out process is obtained by the use of a very simplified model. (auth)

PARTICLE ACCELERATORS

1935   CERN-PS/ER-43

[European Organization for Nuclear Research, Geneva.
    Proton Synchrotron Group].

ON THE INFLUENCE OF MAGNETIC END EFFECTS ON

THE ORBITS. E. Regenstreif. Oct. 1955. 13p.

The effects of stray magnetic fields in synchrotrons have been analyzed theoretically. In particular, the influence of stray fields on the closed orbit deviation at the transition between a magnetic sector and a field free section and on the betatron phase shift is considered. The analysis is limited to second order terms. (M.P.G.)

1936

CASCADE GENERATOR FOR THE ACCELERATION OF PARTICLES AT 4 MEV. Walter Heilpern. Helv. Phys. Acta 28, 485-91(1955) Nov. (In German)

1937

USE OF THE BETATRON IN NUCLEAR PHYSICS. Georges Boulegue. J. phys. radium 16, 872-81(1955). (In French).

The betatron gives a continuous x-ray spectrum from zero energy to the energy of the electrons striking the anode. In order to interpret the results of irradiating a body with a beam for a series of energy values, it is necessary to determine the energy, to know the form of the spectra, and to calibrate the apparatus. Finally, the calculation of effective cross sections as a function of photon energy from the experimentally obtained results requires the solution of an integral equation. (tr-auth)

RADIATION ABSORPTION AND SCATTERING

1938 LRL-83

California Research and Development Co. Livermore Research Lab., Livermore, Calif.
THE FATE OF DEUTERONS IN SOLID ALUMINUM TARGETS. R. A. Heckman and C. J. Egan. Mar. 1954. Decl. Sept. 29, 1955. 19p. Contract AT(11-1)-74.

The effect of deuteron irradiation on two solid Al targets held at temperatures below 250°F during bombardment is described. Bombardments by 19.5-Mev deuterons of 60 hour duration for a total integrated irradiation of 1180 microampere hours, were completed. It was determined that all of the bombarding deuterons were trapped in the target material and were extractable as deuterium gas upon heating the target. A previously unreported phenomenon was observed in the form of a "band" at the end of the range of the deuterons. This "band" was discovered in a metallographic examination of the target section. Metallurgical evidence is presented to support the conclusion that the "band" may be a precipitate from the Al matrix. (auth)

1939 UCRL-3185

California. Univ., Berkeley. Radiation Lab.
DETECTION OF AZIMUTHAL ASYMMETRY IN QUASI-ELASTIC DOUBLE-SCATTERING EXPERIMENTS (thesis). Robert E. Donaldson. Nov. 3, 1955. 33p. Contract W-7405-eng-48.

The asymmetries for a double charge-exchange p-n-p scattering from carbon and tantalum have been observed. These asymmetries are small at small scattering angles and increase with angle to a maximum of $10.4 \pm 2.1\%$ with the first and second scattering angles equal to 45°. Asymmetries in neutron and proton production have also been measured for the quasi-elastic scattering of 285 Mev, $65 \pm 3.8\%$ polarized protons by carbon, lithium, and beryllium targets. The maximum asymmetries observed are about 20%. The neutron data are not antisymmetric about 90° cm, and the proton asymmetries are much smaller than the asymmetries from a free hydrogen target. (auth)

1940 AEC-tr-2359

SINGLE SCATTERING OF POSITIVE IONS IN A GAS. N. V. Fedorenko. Translated from Zhur. Tekh. Fiz. 24, 784-96(1954). 13p. Available from Associated Technical Services (Trans 93G6R), East Orange, N. J.

An investigation was made of the single scattering of positive ions accelerated by voltages in the range of 5 to 30 kv in hydrogen, helium, neon, nitrogen, argon, and krypton for angles in the range $2.5° < \theta < 15°$, analyzing the scattered ions magnetically. Data are given on the scattering without a change of charge of singly charged atomic ions He^+, N^+, Na^+, A^+, Kr^+, I^+, and Pb^+. The number of scattered ions decreases rapidly with increasing scattering angle. For a given energy the heavier ions show greater amount of scattering in the range of small angles. It has been established that the scattering of molecular ions N_2^+, H_2^+, H_3^+ through angles $\theta \geq 2.5°$ is accompanied by dissociation. The scattering of doubly charged ions (A^{++}) is accompanied by electron capture. The scattering of singly charged ions accompanied by stripping was also investigated. Comparison of the data on scattering accompanied by stripping shows that inelastic processes which require a large expenditure of energy take place when the nuclei of the ions and the gas atoms approach each other more closely. Additional maxima have been found on the curves of the angular distribution of ions, the scattering of which was accompanied by stripping. Suggestions are made as to the reasons for the appearance of these maxima, and remarks are made on the phenomenological properties of the inelastic scattering of the ions. (auth)

1941

THE BEHAVIOR OF γ RECOIL ATOMS IN SOLID MEDIA. W. Buser and P. Graf. Helv. Phys. Acta 28, 458-60(1955) Nov. (In German)

1942

ANGULAR DISTRIBUTION OF MULTIPLY SCATTERED GAMMA RADIATION FROM A PLANE ISOTROPIC SOURCE. Martin J. Berger (National Bureau of Standards, Washington, D. C.). J. Appl. Phys. 26, 1504-7(1955) Dec.

A method is given for calculating, within the framework of the moment-method of Spencer and Fano, the angular distribution of radiation from a plane isotropic source. Essential use is made of the simplification introduced by a geometrical feature of radiation from such a source. Sample calculations are presented for a 1-Mev source in water. (auth)

1943

SINGULAR SCATTERING OF ARGON IONS IN GAS STRIPPING. D. M. Kaminker and N. B. Fedorenko. Zhur. Tekh. Fiz. 25, 2239-55(1955) Nov. (In Russian)

A cluster of singly charged argon ions in the energies from 40 to 150 kev was studied. Investigations in conditions limited to singular collision between A^+ ions and argon atoms were made to find the angle of distribution for the A^+ ions scattered without recharge; for the A^{2+}, A^{3+}, A^{4+}, and A^{5+} ions formed during stripping (processes $A^+ \to A^{2+}$, $\to A^+ \to A^{3+}$, $\to A^+ \to A^{4+}$, $A^+ \to A^{5+}$); and, for fast neutral atoms occurring during resonance recharge $A^+ \to A^0$. Variations were kept within the limits of 0 to 15° deviation from the direction of the original cluster. A general method

was developed for calculations of absolute differential cross sections of scattering processes with variation of the charge $d\sigma/dw$ for all angles including $\theta = 0°$. It was found that recharging and scattering without recharge happens at small angles of deviation, while stripping occurs at large angles. On the curve $d\sigma/dw = f(\theta)$ for scattering with stripping exists a central maximum at $\theta = 0°$, and a second maximum displaced from the direction of the original cluster. The angle corresponding to the position of the second maximum grows with the increase of the stripping order and with the reduction of the original ions energy. The integral effective cross sections of the stripping processes are calculated on the basis of the angular distribution curves. With the original energy of the ions at $T = 75$ kev: $\sigma_{1-2} \simeq 1.4 \times 10^{-16}$, $\sigma_{1-3} \simeq 2.5 \times 10^{-17}$, $\sigma_{1-4} \simeq 6.0 \times 10^{-18}$, $\sigma_{1-5} \simeq 1.8 \times 10^{-18}$ cm^2. Neon, helium, and krypton were investigated for the $A^+ \rightarrow A^{4+}$ stripping process. (tr-auth)

Refer also to abstracts 1911 and 1927.

RADIATION EFFECTS

1944   NYO-7379
Carnegie Inst. of Tech., Pittsburgh.
RADIATION EFFECTS IN SOLIDS. Progress Report for July 1954—July 1955. Dept. of Physics. R. Smoluchowski, W. J. Leivo, H. Ingham, K. Kobayashi, P. V. Mitchell, E. A. Pearlstein, and W. H. Vaughan. Sept. 9, 1955. 9p. Contract AT-(30-1)-1193.

Electrical conductivity, density, elastic constants, stored energy, and optical absorption has been measured on irradiated and non-irradiated KCl and NaCl crystals. The results indicate that there are several thousand vacancies produced per incident high energy proton. The mechanism of annealing is being investigated in detail. Experimental results on the dependence of irradiation effects in tungsten upon the energy of the incident protons agree with theoretical calculations based on the previously proposed star formation model. Neutron irradiation of alpha brass can be accounted for in terms of the formation of short-range order. (auth)

1945   AEC-tr-2358
VISIBLE LUMINESCENCE OF PURE LIQUIDS UNDER THE INFLUENCE OF γ-RADIATION. P. A. Cherenkov. Translated from Doklady Akad. Nauk S.S.S.R. 2, 451-4(1934). 4p. Available from Associated Technical Services (Trans 83G7R), East Orange, N. J.

Visual measurements are reported of the luminescence excited by γ rays in liquids. In spite of the different chemical structure of the liquids, the intensities of their luminescence was found to vary within relatively small limits, and the luminescence was concentrated in the blue-violet region of the spectrum. The majority of the liquids did not luminesce when excited by x rays. (M.P.G.)

1946

EFFECTS OF RADIATION ON ORGANOPOLYSILOXANES. E. L. Warrick (Mellon Inst., Pittsburgh). Ind. Eng. Chem. 47, 2388-93(1955) Nov.

Vulcanization of organopolysiloxane elastomers by radiation gave rubbers with superior high-temperature properties. The resistance of these elastomers to radiation cross linking is discussed. (C.W.H.)

1947

FORMATION OF COLOR CENTERS IN GLASSES EXPOSED TO GAMMA RADIATION. N. J. Kreidl and J. R. Hensler (Bausch and Lomb Optical Co., Rochester, N. Y.). J. Am. Ceram. Soc. 38, 423-32(1955) Dec.

Glasses exposed to gamma radiation develop a visible absorption band similar to the F-band developed in alkali halide crystals. The function of cerium in preventing coloration of glass was studied in detail in an ultraviolet-transmitting phosphate base glass in which its characteristic absorption could be measured. When visible absorption was thus prevented, radiation still caused a strong absorption in the ultraviolet which was associated with the electronic structure of cerium. On this basis, transition ions of similar electronic structure were introduced. It was found that iron, manganese, cobalt, nickel, vanadium, copper, and, under certain conditions, some other elements do suppress the formation of the visible absorption band formed in the base glass by radiation while forming more or less prominent bands in other spectral regions. Thus the colorless iron phosphate glass remained colorless under radiation and could be considered to be "protected." Conversely, with cobalt the new band which reached into the visible was relatively intense and stable, suggesting its use to indicate radiation dose. (auth)

Refer also to abstracts 1849 and 1975.

RADIOACTIVITY

1948   UCRL-3176
California. Univ., Berkeley. Radiation Lab.
SEMI-EMPIRICAL CORRELATIONS OF ALPHA DECAY RATES AND ENERGIES. Charles J. Gallagher, Jr. and John O. Rasmussen. Oct. 26, 1955. 22p. Contract W-7405-eng-48.

Data on α decay rates and energy for all observed α groups emitted from nuclei with more than 128 neutrons have been studied in an attempt to establish correlations. Results are presented in the form of hindrance factor histograms to illustrate the distribution of the deviations from simple theory. (M.P.G.)

1949

A NOTE ON EVIDENCE FOR A 2.158 MEV LEVEL IN Ni^{60}. J. L. Wolfson (Jewish General Hospital, Montreal, Canada). Can. J. Phys. 33, 886-8(1955) Dec.

A double-lens magnetic β-ray spectrometer was used to study a Co^{60} source, and the resultant spectrum is shown. Results indicate the presence of a 2.158 Mev level in Ni^{60}. (B.J.H.)

1950

ON THE INTERNAL AND EXTERNAL BREMSSTRAHLUNG OF Pm^{147} AND Pr^{143}. Helene Langevin-Joliot. Compt. rend. 241, 1286-8(1955). November 7. (In French)

The internal bremsstrahlung spectrum of Pm^{147}, obtained by a scintillation spectrometer in an appropriate arrangement, disagrees with theory in both its shape and intensity. The number of photons reaches 450% of the theoretical value above 60 kev. The first results on Pr^{143} also indicate an excess of photons. (tr-auth)

1951

ON THE BREMSSTRAHLUNG RADIATION AND AUTOIONIZATION IN THE K LEVEL ACCOMPANYING THE DISINTEGRATION OF Pm^{147}. Helene Langevin-Joliot. Compt. rend. 241, 1390-2(1955) November 14. (In French)

A proportioned counter was used in the study of the bremsstrahlung radiation of Pm^{147} and autoionization in the K level. The Pm^{147} decay probability in the K level ionization was calculated to be $1.25 \pm 0.25 \times 10^{-4}$. (tr-auth)

1952

ON A NEW METHOD OF STUDYING RADIOACTIVE PHENOMENA: CINE-NUCLEOGRAPHY APPLICATION TO THE MEASUREMENT OF THE HALF LIFE OF RADIUM C'. POSSIBILITY OF ITS USE FOR THE DETERMINATION OF THE HALF LIVES OF ARTIFICIAL RADIOELEMENTS. Marcel LaPorte. J. phys. radium 16, 817-23(1955) Nov. (In French).

By selective evaporation of RaC' from an active deposit, a source of RaC', which is entrained under a nuclear plate, is effected at the periphery of a mobile disk. From the exponential decrease of the number of traces observed in narrow bands perpendicular to the velocity, the half life of RaC' is deduced very simply ($T = 1.5 \times 10^{-4}$ s). A generalization is indicated for the use of the method for the determination of the half lives of artificial radioelements, particularly in the region $10^{-2} \geq T \geq 10^{-4}$ s. (tr-auth)

1953

CONTRIBUTION TO THE DISINTEGRATION SCHEME OF Ir^{192}. F. Grard, L. Danguy, and J. Franeau. J. phys. radium 16, 839-43(1955) Nov. (In French)

A double-focusing Siegbahn-Swartholm spectrograph was used to study the conversion spectra of Ir^{192}, with a 7μ lead radiator, between 180 and 550 kev. The examination was carried out mainly on low-intensity γ rays in order to determine their origin and energy. The results confirm the recently proposed disintegration schemes. Moreover, the probable existence of a 511-kev ray was pointed out, indicating possible positron emission or pair formation in the disintegration of Ir^{192}. (tr-auth)

1954

INVESTIGATION OF THE DECAY OF Co^{61} WITH A SCINTILLATION SPECTROMETER. P. Erdös, P. Jordan, D. Maeder, and P. Stoll. Helv. Phys. Acta 28, 323-5(1955) Aug. (In German)

1955

DIRECTIONAL CORRELATION MEASUREMENT OF Ta^{181}. E. Heer, R. Rüetschi, F. Gimmi, and W. Kündig. Helv. Phys. Acta 28, 336-7(1955) Aug. (In German)

1956

STUDY OF THE 197 AND 195 ISOTOPES OF GOLD AND MERCURY. R. Joly, J. Brunner, J. Halter, and O. Huber. Helv. Phys. Acta 28, 403-41(1955) Aug. (In French)

The $Hg^{197}-Au^{197}$ and $Hg^{195}-Au^{195}$ isotopes are examined in a β-lens spectrometer and a γ pulse spectrograph. $\beta-\beta$ and $\gamma-\gamma$ coincidence measurements yield the sequence of the different transitions. The resulting decay schemes show a remarkable agreement. The conversion coefficients of the main γ transitions along with spin and parity of the excited levels can be computed with the help of coincidence measurements, in conjunction with absolute β and γ measurements. Some of the levels present can be explained by single-particle states. Using the experimental results, the β theory gives an evaluation of the energy difference between the ground states of the corresponding Hg−Au isotopes. (tr-auth)

1957

THE CONVERSION ELECTRON CORRELATION OF Hg^{197} AND Ta^{181}. F. Gimmi, E. Heer, and P. Scherrer. Helv. Phys. Acta 28, 470-2(1955) Nov. (In German)

1958

ON THE DISINTEGRATION OF Hg^{195}, Hg^{194}, AND Hg^{193}. J. Brunner, H. Guhl, J. Halter, and H. J. Leisi. Helv. Phys. Acta 28, 475-8(1955) Nov. (In German)

1959

INVESTIGATION OF THE β DISINTEGRATION OF Ne^{23}. H. J. Gerber, M. Garcia Munoz, and D. Maeder. Helv. Phys. Acta 28, 478-80(1955) Nov. (In German)

SHIELDING

1960

X-RAY ATTENUATION IN LEAD, ALUMINUM, AND CONCRETE IN THE RANGE 275 TO 525 KILOVOLTS. William Miller and R. J. Kennedy (National Bureau of Standards, Washington, D. C.). Radiology 65, 920-5(1955) Dec.

SPECTROSCOPY

1961

A HEATED INFRARED CELL. H. C. Mattraw (Knolls Atomic Power Lab., Schenectady, N. Y.). Appl. Spectroscopy 9, No. 4, 177(1955).

An inexpensive gas cell is described for the determination of infrared spectra of corrosive materials (e.q. UF_6) at temperatures up to 125°C. (C.W.H.)

THEORETICAL PHYSICS

1962   AEC-tr-2355

RENORMALIZATION OF MESON CHARGE IN PSEUDO-SCALAR THEORY WITH PSEUDOSCALAR COUPLING. I. Pomeranchuk. Translated from Doklady Akad. Nauk S.S.S.R. 104, 51-3(1955). 3p.

1963

ATTEMPT TO EXPRESS THE PAULI PRINCIPLE IN THE FORM OF AN "EXCLUSION FORCE." NUMERICAL COMPARISON WITH THE CLASSICAL ELECTRICAL FORCE. Claude Vroelant, Alexandre Laforgue and Jean-Leon Masse. Compt. rend. 241, 1265-6(1955). November 7. (In French).

An attempt was made to fix the Pauli principle by imagining a force which prevents the collision of two electrons of the same spin. The discussion is limited to stationary problems, and two methods were used: reaction in an enclosure, and a force exerted between two statistical positions. An exclusion beam is defined for each. Within the beam, the spin obstacle removed the particle by Coulomb repulsion. (tr-auth)

1964

ON SOME EFFECTS RESULTING FROM THE INTER-

ACTION OF THE ELECTROMAGNETIC FIELD WITH THE
VACUUM OF SCALAR CHARGED PARTICLES.   A.
Akhiezer, V. Aleksin, and D. Volkov.   Doklady Akad. Nauk
S.S.S.R. 104, 830-3(1955) Oct. 21.   (In Russian)

   The interaction of the electromagnetic field with electron-
positron vacuum leads to changes in Coulomb's law and to
a series of non-linear effects (scattering of light by light,
nuclear coherent scattering of γ rays, etc.). Studies of this
effect in the electrodynamics of a particle with zero-spin
are made. (R.V.J.)

1965

CORRELATION OF THE PLANES OF V^0-PAIR DECAY
AND θ^0-MESON SPIN.   L. D. Pusikov and Ya. A.
Smorodinskii.   Doklady Akad. Nauk S.S.S.R. 104, 843-
5(1955) Oct. 21.   (In Russian)

   The angular distribution of λ^0 and θ^0 decay products and
the correlation of both decays are investigated. It is
concluded that the spin of the λ^0 meson is $\geq 7/2$, the spin
of θ^0 differs from zero, and the spin of θ^0 is smaller than
the spin of λ^0. (R.V.J.)

1966

NEUTRON-PROTON POTENTIAL AND PHOTODISINTE-
GRATION OF THE DEUTERON.   K. Chadan.   J. phys.
radium 16, 843-8(1955) Nov.   (In French)

   Recent work on the exact determination of the neutron-
proton potential according to the hypothesis of central
forces, has shown that in the case where the system is
found in the triplet spin state, the potential is determined
uniquely by the law of variation, as a function of the energy,
of the triplet S phase displacement, by the binding energy
of the deuteron, and by a certain parameter related to the
deuteron wave function. It is shown that this parameter can
be deduced from the slope at the threshold of the curve of
the effective total photodisintegration cross section of the
deuteron as a function of energy. In the general case, it is
shown that there is always at least one value of the
parameter compatible with this slope. The general method
is applied to a particular variation of the phase displace-
ment and the corresponding potential is deduced. (tr-auth)

1967

NONADIABATIC TREATMENT OF NUCLEAR FORCES.
II. NONSTATIC CORRECTIONS.   Junji Iwadare (Kyoto
Univ., Japan).   Progr. Theoret. Phys. (Japan) 14, 16-26
(1955) July.

   The nonstatic corrections to the second plus fourth order
potentials are studied in the symmetrical Ps(ps) meson
theory. The potentials are constructed by means of
canonical transformation, and the nonstatic corrections are
obtained by the use of the expansion in powers of
$(p/2M) \sim (k/2M) \sim (\mu/2M)$, the validity of which is ex-
amined for the special case of the no-pair contributions.
The nonstatic corrections are negligible for the large
separation $r > 1/\mu$ between two nucleons and are large in
the interior region, but would not alter the main features of
the static potentials except for the central force in triplet
odd state and the one-pair contributions. The results for
the small separation should be accepted only qualitatively
because of the inadequacy of the power series expansion in
this region. It is shown that the separation of the no-pair
contributions from the one- and the two-pair contributions
leads to unreasonable results for the velocity dependent
potentials, and that the more careful treatment is needed
for the inclusion of the effects of the pair suppression.

The spin-orbit coupling in the two-pair contributions ob-
tained by Klein is found to be cancelled by the inclusion of
the one-pair contributions. Finally, it is remarked that the
potentials determined by this canonical transformation
give the correct results for the scattering problem up to g^4.
(auth)

1968

EXPLICIT FORMULAE OF BETA-GAMMA DIRECTIONAL
CORRELATION.   Masato Morita (Kobayasi Inst. of
Physical Research, Kokubunzi, Tokyo).   Progr. Theoret.
Phys. (Japan) 14, 27-36(1955) July.

   The $\beta-\gamma$ directional correlation function is expressed as
a series in the Legendre polynomials:

$$\omega(\theta) = \sum_{L_1 \leq L_2} \sum_n c^{(2n)}_{L_1 L_2} b^{(2n)}_{L_1 L_2} P_{2n}(\cos\theta),$$

where $c^{(2n)}_{L_1 L_2}$'s are the numerical coefficients which depend
upon the spin assignments of the nuclei and the multi-
polarities of γ ray. Their numerical values are tabulated
for the most interesting transition schemes. The param-
eters for the β-ray, $b^{(2n)}_{L_1 L_2}$, are also given in convenient
formulas to analyze the experimental data. (auth)

1969

ON THE MESON-THEORETICAL POTENTIALS.   Shoichiro
Otsuki and Ryozo Tamagaki (Kyoto Univ., Japan).   Progr.
Theoret. Phys. (Japan) 14, 52-64(1955) July.

   Properties of the second order nuclear potentials derived
from the symmetrical pseudoscalar meson theory are ex-
amined with respect to such phenomena that the fourth and
higher order nuclear forces do not take a serious role.
Informations originating from p–p scattering at low and
intermediate energies furnish a strong confirmation of the
second order potentials. Corrections which are required
to the second order potentials by the experimental data are
estimated and are found to be not inconsistent with the
fourth order potentials. (auth)

1970

DOUBLE MESON PRODUCTION IN THE INTERMEDIATE-
COUPLING THEORY.   I. Akira Komatsuzawa and Yasuo
Munakata (Kyoto Univ., Japan) and Hiroichi Hasegawa
(Osaka City Univ., Japan).   Progr. Theoret. Phys. (Japan)
14, 65-74(1955) July.

   The intermediate-coupling theory is applied to the
problem of the meson production in meson-nucleon colli-
sions. For simplicity, the model used is a charged scalar
meson field interacting with a fixed nucleon. The amplitudes
of the ordinary scattering and the meson production are
obtained in the "one-level approximation." (auth)

1971

FORMAL THEORY OF NUCLEAR DIRECT INTERACTION
IN NUCLEAR SCATTERING.   Haruo Ui (Univ. of Tokyo).
Progr. Theoret. Phys. (Japan) 14, 75-6(1955) July.

1972

ON THE GAMMA-TRANSITION OF NUCLEI.   Mitsuo Sano.
(Kyoto Univ., Japan).   Progr. Theoret. Phys. (Japan) 14,
81-94(1955) Aug.

   Using A. Bohr's collective model, the γ transition of
nuclei is studied by the approximations of weak and strong
couplings. In the M4 transition, the agreement of experi-
mental data with theoretical results is in general much
better on this model than one predicted on other nuclear
models, if the strong-coupling approximation is adopted.

The results of these two approximations are compared with one another. The difference between them comes from contributions due to a deformed core. These contributions, and consequently the difference between the weak and strong coupling approximations, increase with the order of multipolarity of radiation. In E3 transitions (j-forbiddenness), such as those between $p_{1/2}$ and $\frac{7}{2}^+$ states, it is necessary to take into account the nuclear configuration mixing due to the surface coupling. Especially, the coupling with deformations of order three is important for these transitions. (auth)

1973

SEPARATION ENERGIES AND NUCLEAR STRUCTURES IN LIGHT NUCLEI. Takao Tati (Kanazawa Univ., Japan). Progr. Theoret Phys. (Japan) 14, 107-25(1955) Aug.

The separation energies of light nuclei ($10 \lesssim A \lesssim 50$) are considered in relation to the nuclear structure. We can grasp the physical meaning of the complicated variation of the separation energies of nucleons from nucleus to nucleus phenomenologically, by comparing them with the contributions to the separation energies, from each term of the semi-empirical mass formula. The systematic deviation of the separation energies from the semi-empirical mass formula disappears by the corrected mass formula by the uniform model which assumes the two-body interactions between symmetric pairs in supermultiplet structure. This fact strongly supports that the symmetry effect of the nuclear binding energy originates from the above mentioned two-body interactions. The deviations of the separation energies from the corrected mass formula of the uniform model show the evidences to support the independent particle model. In this mass region, the nucleus has, besides the dominant supermultiplet structure, the j-j coupling shell structure. The comparison between the mass formula and the above mentioned potential energy of two-body interactions which give the symmetry effects quantitatively, and the requirement that the separation energy is nearly equal to the depth of the energy level of the last nucleon measured from the top of the potential in the independent particle model, lead us to the conclusion that there are other kinds of nuclear potential energies which are not sensitive to the symmetry effect and to the "expansibility" of the nucleus, and bear about a half of the total potential energy of the nucleus. And then, the depth of the average potential for the last nucleon is estimated to be about 50 Mev and is a linearly decreasing function of X (X = Z−N for protons, X = N−Z for neutrons). (auth)

1974

DEVELOPMENT OF QUANTUM ELECTRODYNAMICS. V. B. Berestetskii. Vestnik Akad. Nauk S.S.S.R. 25, 22-31 (1955) Oct. (In Russian)

Refer also to abstract 1892.

URANIUM AND URANIUM COMPOUNDS

1975   KAPL-1158
Knolls Atomic Power Lab., Schenectady, N. Y.
X-RAY DIFFRACTION EFFECTS TO BE EXPECTED FROM IRRADIATED URANIUM. W. M. Cashin and C. W. Tucker, Jr. Aug. 13, 1954. Decl. Oct. 6, 1955. 13p. Contract W-31-109-Eng-52.

The expected x-ray effects in irradiated uranium are compared with effects in ionic, covalent, and metallic crystals. The unique changes due to fission product formation are discussed. Some criteria for the suitability of experimental techniques in the study of damage are presented. (auth)

1976

α–γ COINCIDENCES AND HALF LIFE OF U^{235}. P. Huber, K. P. Meyer, and E. Würger. Helv. Phys. Acta 28, 326-8(1955) Aug. (In German)

Refer also to abstract 1803.